2020 Summary Report
Tech Trek
Wearable Tech STEM Camp

August 2020

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Tech Trek Executive Summary

In partnership with Qualcomm® Thinkabit Lab™, the American Association of University Women (AAUW) offered a virtual Wearable Tech Trek. The camp was offered from August 3-7, 2020 with 40 girls from 31 nearby middle schools. From pre-survey, 85% of students (34 out of 40) were both comfortable using the online question and answer system, and with collaborating online with other students to complete activities or assignments, and 93% (37) reported being comfortable using chat rooms and breakout groups for small group discussions.

Key Findings

QWOW Findings

1. Although 78% mentioned they have had opportunities to learn about Strengths, Interests, and Values (SIVs), only 33% said they knew their own SIVs at the beginning of camp.
2. By the end of camp, 67% said they knew about their SIVs. This was a 34% of statistically significant ($p = .002$) increase from pre to post-survey.
3. By the end of camp, 88% were "Very confident" or "Confident" in designing an IoT invention.
4. By the end of camp, 95% were "Very confident" or "Confident" in using an engineering design process.

Engineering Findings

1. At the beginning of camp, 94% of students said they have had opportunities to learn coding and programming, and between 33-56% have worked with LEDs and Servos. At the end of camp, some were very confident and others not confident about making a circuit, and programming an Arduino to work an LED or Servo.
2. By the end of camp, there was a statistically significant increase ($p = 0.24$) in campers viewing themselves as an inventor.

Findings of Increased Confidence in Collaboration and Sharing from Post-survey Respondents

1. 21% increase in liking to share their design ideas.
2. 22% increase in enjoying collaborating with others.

Findings of Increased Confidence in Problem-Solving Skills

1. 24% statistically significant increase in knowing how to overcome problems ($p = .010$).
2. 29% statistically significant increase in the percentage of knowing how to solve technical issues ($p < .001$).
3. 15% statistically significant increase in feeling "Yes, absolutely," or "Quite a bit" comfortable asking for help when needed ($p = .010$).

Findings of Increased Interest to Take Advanced Courses in High School

1. 31% statistically significant increase interest in taking engineering/robotics courses in high school ($p < .001$).
2. 16% statistically significant increased interest in taking computer science courses ($p < .001$).
3. 19% statistically significant increased interest in taking advanced mathematics course ($p = .006$).

Career Aspiration Findings

1. 37% statistically significant gain ($p < .001$) in coding and programming.
2. 24% statistically significant gain ($p = .006$) in students' interest in mathematics.

3. 13% statistically significant gain ($p = .003$) in engineering and computer science.
4. 12% statistically significant gain ($p = .032$) in their interest in science.

Conclusion

Students enjoyed the Tech Trek Wearable Virtual Camp. As indicated by the significant gains in many different aspects of the camp program, the Tech Trek Camp had an impact on the young women who participated. It is interesting that when students were given an option to name two careers of interest to them at both pre- and post-survey, those specifying engineering as their first career choice went from 15% to 41%. The daily opportunities to hear virtually from a woman engineer or scientist of color may have been a contributing factor.

Participants and Wearable Tech Trek Camp Information

The American Association of University Women (AAUW) in partnership with Qualcomm® Thinkabit Lab™ offered its virtual Wearable Tech Trek from August 3-7, 2020. The camp had 40 middle school girls from 31 middle schools, and was facilitated by two instructors and 15 interns. There were 9 interns who were either high school or college students and 6 adult interns, and they were either trained to provide Build support or Social support. The lead instructors trained the interns before camp to act as Build or Social coaches for breakout rooms. Most of the Build coaches completed the hat themselves to get familiar with the process. Each day, students were expected to spend 3 hours on their project and an additional hour was assigned as *Inspiration Hour* for the girls to be inspired and motivated with female speakers.

Data collection was through pre- and post-surveys and daily reflections. There was a 100% response rate for the pre-survey and 98% for the post-survey (see Table 1). Also, students reflected on their daily learning through a structured reflection sheet which had questions pertaining to the activities covered that day. The reflection response rate was from 93 - 100%, a very high rate for daily reflections. Possibly the way it was set up helped students to feel comfortable contributing. In one students' word:

- *I believe the way you set-up Tech Trek virtually was just perfect. Getting an email every day from Dr. Mimi was very heartwarming & filling out my daily reflections gave me a chance to recap everything I learned that day. This camp has helped me find an interest of mine, coding/working with the Arduino board. Thank You All for making this possible! This camp has truly changed my life. I already miss it :(*

Table 1: Response Rate for Pre- and Post-Surveys

Pre-Survey	Post-Survey	Daily Reflection			
		Monday	Tuesday	Wednesday	Thursday
100%	98%	100%	100%	93%	98%

Comfort with Online Program

On each day of the camp, participants reflected on their daily learning. These reflections opened with the original three questions about their comfort with various parts of the virtual camp such as using the online question and answer system, collaborating online, and their comfort in using the chat room or breakout rooms. The result of the first day is discussed here to get an understanding of the participants' overall comfort with a virtual camp. 85% of students (34 out of 40) were both comfortable using the online question and answer system, and with collaborating online with other students to complete activities or assignments. 93% (37) reported being comfortable using chat rooms and breakout groups for small group discussions.

Students' Expectation from Camp

At pre-survey, students were asked what were they looking forward to at Camp. Table 2 shows that they were almost equally looking forward to learning new things (40% or 16 out of 40), followed closely by coding/programming (35% or 14 out of 40). Other mentions were building, meeting others, and hearing from professionals. Their categorized responses follow:

- Learning new things (16)
- *I am looking forward to learning new information and working with other people.*
- *I am most looking forward to meeting new people and learning new things!*
- *Learning new things and making new friends.*
- *I am most looking forward to taking this opportunity to learn about STEM to advance my knowledge and understanding.*
- *To learn more about Science and learn new skills.*
- *I am most looking forward to learning new things about science, and technology.*
- *Learning new things in the robotics field.*
- *Learning more about engineering.*
- *Learning something new - 8*

- Coding, programming (14)
- *I'm excited to learn more about coding and programming.*
- *Learning more related to coding and programming, because I'm not very educated in that field.*
- *I am looking forward to learning more about coding and engineering.*
- *I am looking forward to getting to learn different coding languages and to be able to do some programming.*
- *Using the new software on my computer for coding.*
- *Coding something, I can use every day.*
- *To learn how to code.*
- *Learning coding.*
- *Getting the coding experience.*
- *I am looking forward to learn more advanced coding and programming.*
- *Because I've never really immersed myself into the world of coding/robotics, I'm excited to start the adventure of this new world of programming.*
- *I've never completed a Robotics/ Coding camp before so I am beyond excited to learn something new. I've never had an interest is coding but I have never tried coding so maybe this could open another opportunity for my future.*
- *I'm looking forward to understanding more of the coding language, and also how to incorporate basic knowledge of that into more complex builds and ideas. I am also very excited to meet other girls with this interest.*
- *Taking my robotics and programming skills to the next level.*

- Building (4)
- *Building robots.*
- *Building a robot.*
- *Working with others to make something new that I wouldn't be able to make before camp.*
- *I am most looking forward to using my skills to make something.*

- Meeting others with similar interests (4, plus 1 included in a response above)
- *Meeting other girls who love STEM.*

- *I look forward to collaborating with other girls my age who have the same interest as I do.*
- *I'm looking forward to meeting new people who have similar interests to me and also just spending some time of my summer doing something I am interested in! I overall just think that this'll be a great experience for me, and I can't wait!*
- *Work with fellow peers while getting to know girls with similar interests and being taught and spoken to by brilliant women in a variety of science fields (especially medicine).*

- Meeting professionals (2, plus 1 included in a response above)
- *Currently I am looking forward to the opportunity to meet professional mentors, it excites me to meet such successful women in the STEM area.*
- *I am looking forward to learning the stories of successful people who work in STEM and obtaining advice to help guide me to what I truly want to do career-wise.*

Table 2: Number and Percent of Students' Expectations of Tech Trek Camp

Expectations Before Camp (n = 40)		
	Number	Percent
Learning new things	16	40%
Coding/Programming	14	35%
Hands-on opportunity to invent and build	4	10%
Meeting with Professionals	2	5%
Miscellaneous	4	10%

Students' Concerns about Camp

A follow-up question to their expectations was what were they most worried about or concerned about regarding camp before starting. Out of 40 students, 33 offered responses to this question. One student had no worries. The majority (55% or 18 out of 33) expressed concerns about how they would perform, with most of those (10 out of 18) being due to a lack of previous STEM experience. Students also mentioned concerns about connecting with others, and doing their work virtually. And a few specifically mentioned coding. Categorized responses follow:

- Lack of prior experience (10)
- *I'm nervous because I haven't worked with Arduino software before.*
- *Not knowing enough about coding and programming.*
- *I am worried that, because of my lack of involvement in STEM, that I will not be able to exceed as others might.*
- *My lack of knowledge on the subject, I've got no experience.*
- *Not having that much background knowledge about STEM.*
- *I have never taken a robotics or coding class.*
- *One thing I am most worried about is falling behind. I have absolutely no experience with coding or computers so I hope I am not lost & instead I end up learning something new! This is a new challenge that I hope to overcome.*
- *Not being prepared enough.*

- *I will be the stupidest one there. I won't know as much as the others since I have not had a whole lot of robotics or coding. I don't want to embarrass myself.*
- *That I don't know enough about science.*

- Not understanding, not keeping up (8)
- *I am most worried about not being able to understand the tasks.*
- *I won't understand it.*
- *Being late to class/oversleeping and not understanding.*
- *I'm worried about not being able to keep up.*
- *Not getting things right.*
- *Not being able to grasp the information for what we are learning and doing.*
- *I am worried that I might fall behind.*
- *I will be the dumbest person there.*

- Social interaction and working virtually (9)
- *That I will not be to connect with my teammates.*
- *Meeting new people.*
- *Social interaction.*
- *Connecting with virtual people.*
- *I'm not worried about too much in the camp except that maybe I'll have trouble connecting with others since we are in a virtual environment. Obviously, I want to make new friends and meet new people, I just don't quite know how that'll work out for me just yet! Nonetheless, I think I'll definitely be able to meet some new people and connect with them, so this isn't something that worries me a lot!*
- *I am worried that we might not be able to have the full experience since we will be over zoom.*
- *Probably not knowing what to do since things are more complicated online.*
- *I am worried that I won't be able to get fully engaged with the material as we are doing this through a computer and not in person.*
- *I am most worried about my connection logging me out of zoom.*

- Coding, technology (4)
- *I would be most worried about coding.*
- *Coding and the computer science.*
- *Having issues in my programming.*
- *I am worried about if when getting the software connected to the computer, I did something wrong.*

- Other (2)
- *I don't think there is anything that I am particularly worried about.*
- *That I will get bored.*

Table 3: Number and Percent of Students' Expectations of Wearable Camp

Worries Before Camp (n = 33)		
	Number	Percent
Lack of prior experience	10	30%
Not being able to understand and keep up	8	24%
Social interaction and virtual camp	9	27%
Coding/Programming	4	12%
Miscellaneous	2	6%

On the pre-survey, when students were prompted to ask other questions and/or to provide other comments, most did not have any other questions or comments, and those who responded simply expressed their appreciation for the experience. Here is what they said:

- *I'm just so excited to be able to explore this opportunity.*
- *I am very grateful that I was given this chance and thank you to all of you who put this camp together after everything that is going on in the world right now.*
- *Not any that I can think of right now. Thank you for being so flexible during this time and still giving us an opportunity to get a portion of what the Tech Trek experience would be!*
- *I just want to say thank you for this opportunity! But I do not have any questions as of now :)*
- *My cousin's friend Alexi went to Tech Trek and she said she would've have been a counselor this year if we had been at a college.*

However, one real question was also expressed: "How are the online lessons going to be grouped and will it be sort of like a tutorial video where we follow along the person in charge?"

Interest in Science, Technology, Engineering, and Math (STEM), and STEM Careers

Students identified their interest in STEM fields (Science, Technology, Engineering, and Mathematics) at the pre- and post-survey by selecting one of the four options: Yes absolutely, Quite a bit, A little, or Not at all. Table 4A demonstrates an increase of interest in all STEM fields. These increases were from 5%- 24%. It is interesting that students' interest in mathematics showed a 24% statistically significant gain (p = .006), followed by a 12% statistically significant gain (p = .032) in their interest toward science.

Table 4A: Number and Percent of Pre- and Post-Survey Data on Students' Interest in STEM Fields

I am interested in…	Yes, absolutely!		Quite a bit		A little		Not at all	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Pre-Survey (n = 40)								
Science	31	78%	8	20%	1	2%	0	0
Technology	22	55%	16	40%	2	5%	0	0
Engineering	22	55%	11	28%	7	18%	0	0
Mathematics	20	50%	16	40%	4	10%	0	0
Post-Survey (n = 39)								
Science	35	90%	4	10%	0	0%	0	0
Technology	26	67%	11	28%	2	5%	0	0
Engineering	24	62%	12	31%	2	5%	1	2%
Mathematics	29	74%	6	16%	4	10%	0	0

Further exploration of students' interest in STEM careers came from asking them about their interests in coding/programming, in pursuing engineering or computer science, and in pursuing other STEM careers (e.g. biology, chemistry, medicine, etc.). Table 4B shows an increase in the girls' interest in all of these careers. Particularly, they indicated a 37% statistically significant gain ($p < .001$) in coding and programming, and a 13% statistically significant gain ($p = .003$) in engineering and computer science. They also showed a 6% gain in their interest in other STEM fields such as biology, chemistry, medicine, etc. but it was not a significant gain. This is further observed in students' responses to direct questions asked at the post-survey. Table 4C displays that 75% of the students are "Very confident," or "Confident" that they can become an engineer, or they are 98% "Very confident," or "Confident" that they can become a computer scientist or programmer if they want to.

Table 4B: Number and Percent of Pre- and Post-Survey Data on Students' Interest in Coding/Programming, Engineering/Computer Science, and Other STEM Fields

I am interested in…	Yes, absolutely!		Quite a bit		A little		Not at all	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Pre-Survey (n = 40)								
Coding/Programming	12	30%	16	40%	12	30%	0	0
Engineering/Computer Science	6	15%	15	38%	11	28%	8	20%
Other STEM Fields	23	58%	11	28%	6	15%	0	0
Post-Survey (n = 39)								
Coding/Programming	26	67%	10	26%	3	8%	0	0
Engineering/Computer Science	11	28%	16	41%	9	23%	3	8%
Other STEM Fields	25	64%	11	28%	3	8%	0	0

Table 4C: Number and Percent of Post-Survey Data on Students' Confidence in Becoming an Engineer or Computer Scientist.

	Very Confident		Confident		Slightly Confident		Not Confident	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
I am confident that I can become an engineer.	14	36%	15	39%	9	23%	1	2%
I am confident that I can become a computer scientist or programmer.	31	80%	7	18%	1	2%	0	0

Another opportunity given to students at both pre- and post-survey was to respond to an open-ended question asking them about two career options of interest to them. One student did not respond on the post-survey. There were 80 careers choices identified on the pre-survey and 75 on the post-survey (some only identified one career, or in one case, three). 85% of careers were STEM-related on the pre-survey (with the focus on their first choice and accepting the medical field as part of the STEM careers), and that rose to 95% on the post-survey. Perhaps even more interesting, those specifying engineering as their first career choice went from 15% to 41% (see Table 4D for the list of students' responses).

Table 4D: Students' Selection of Two Careers of Interest

ID	Two Careers of Interest to Students	
	Pre-Survey	**Post-Survey**
Camper1	Space Biologist, Marine Biologist	Electrical Engineer, Software Engineer
Camper2	Medicine and research, Robots to help w/ medicine	Molecular biology research, Medicine
Camper3	Astronaut, Scientist	Scientist, Astronaut
Camper4	Forensic scientist, Criminal data analyst	Data analyst, Engineering
Camper5	Pharmaceutical Scientist, Medical scientist	Medical scientist, Pharmaceutical Scientist
Camper6	Author, Technologist, but also Business woman	Engineer
Camper7	AV Production Tech, Hardware engineer	Coder, Engineer
Camper8	Zoology, Journalism	Engineer, Zoologist
Camper9	Herpetology, Animating/modeling for games	Programmer, Engineer
Camper10	FBI Agent, Computer engineer/data analyst	FBI Agent, Computer engineer
Camper11	Biomedical engineer, Forensic psychology	Medicine, Engineer
Camper12	Game development, Photography	Game development, Photography
Camper13	Architect, Software developer	Computer engineer, Coder
Camper14	Neuroscientist, Entrepreneur	Brain surgeon, Chemist
Camper15	Medical field, Astrology	Engineer, Environmental lawyer
Camper16	Pediatrician, Astronaut	Design engineer, Aerospace engineer
Camper17	Pediatrics, Medicine	My interest in careers hasn't changed since camp but I found out more about STEM careers
Camper18	Engineer, Lawyer	Electrical Engineer, Software Engineer

Camper19	Marine biology, Wildlife biology	Wildlife biology, Marine biology
Camper20	Chemist, Engineer	Chemist, Engineer
Camper21	Computer science, Engineering	Engineering, Computer science
Camper22	Astronaut, Biologist	Biology, Astronaut
Camper23	Family doctor	Biochemistry, Biochemical engineering
Camper24	Engineering, Technology	Engineering, Technology
Camper25	Pediatrician, Family Medicine	Software Engineer, Pediatrician
Camper26	Biochemistry, Inventing	Inventing, Biochemistry
Camper27	Doctor, Botanist	Doctor, Botanist
Camper28	Mechanical engineering, Teaching	Hardware engineer, Electrical engineer
Camper29	Astronaut, Medical profession	Astronaut, Doctor
Camper30	Lawyer, Teacher	Business Development, Government Affairs
Camper31	Biomedical engineering, Mechanical engineer	IT engineer, Cyber security
Camper32	Forensic scientist, Chemical engineer	
Camper33	Neurosurgeon, Pediatric doctor	I am still extremely interested in becoming a neurosurgeon, but as a result of the camp, I have also found an interest in cybersecurity since I was really inspired by Rachel Wilson. I am also interested in computer scientist as the whole coding and programming in general was really fascinating and cool!
Camper34	Astronaut, Aerospace engineer	Aerospace engineering, Astronaut
Camper35	Medical field	Although I never considered becoming an engineer or anything related to that, I still got an idea to what it would be like. It is not something I'd personally do as a career but it is definitely interesting and something cool to learn.
Camper36	Pediatrics, Teacher	Pediatrician
Camper37	Neurologist, Cardiologist	Engineering, Neurologist
Camper38	Wildlife Biology, Marine Biology	Wildlife Biology, Marine science
Camper39	Designer, Research Doctor	Engineering, Medicine
Camper40	Biomedical engineer, Environmental engineer	Mechanical engineer, Environmental engineer

Students' Knowledge of Their Own SIVs and Career Interests

When asked if they knew about their Strengths, Interests, and Values (SIVs), at the pre-survey, only 33% said they had knowledge of their own SIVs (see Table 5A). This is interesting because 83% admitted to have learned about SIVs before (see Table 6A). By the end of camp (see Table 5A), 67% said they knew about their SIVs. This came with a 34% increase from pre to post-survey and this increase was statistically significant ($p = .002$).

Table 5A: Number and Percent of Pre- and Post-Survey Data on Students' Evaluation of Own Knowledge

I know…	Yes, absolutely!		Quite a bit		A little		Not at all	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Pre-Survey (n = 40)								
My SIVs	13	33%	23	58%	4	10%	0	0
Careers that interest me	22	55%	14	35%	4	10%	0	0
Post-Survey (n = 39)								
My SIVs	26	67%	11	28%	2	5%	0	0
Careers that interest me	22	56%	14	36%	3	8%	0	0

To explore whether students could connect their learning of SIVs to their future, during the reflection time, they were also asked to complete the following statement: "Including my strengths, interests, and values will help me in my future by _____." Students' responses at the end of the first day are examined here. Interestingly, approximately two thirds of students (27 out of 40) commented how knowing their SIVs would help them to find a career, something they would be successful at and enjoy (see Table 7B). Others (7 or 18%) responded with how it would help them know themselves better, and a few (6 or 18%) had ideas about how it could help them be better in specific ways. Categorized responses follow:

- Finding a suitable, enjoyable career (27)

- *The majority of responses (16) were something like: "Helping me choose a career that is best for me, that I will enjoy." Other responses follow:*
- *Helping me to know what career will make me happy in life.*
- *Helping me evaluate and compare my interests to a future career.*
- *Helping me understand my preferences, and strengths in my work field and in life.*
- *Helping me figure out job to go into and how I would like to live most.*
- *Finding an interesting job that I will enjoy.*
- *Making decisions as of careers and majors.*
- *They can tell me what makes me happy and help determine what I will be successful at.*
- *Finding a future that is suited for me and represents me as an individual.*
- *Guiding me to a job that I am passionate about and knowing what I am capable of doing.*
- *Examining my strengths, interests, & values this afternoon has helped me get an idea of what I want my future to be by revealing hidden interests that I didn't know I had & opening up my options. This has made me realize that maybe my "dream job" isn't what I will be 100% satisfied with in my future. Finding these interests of mine has opened up many new job opportunities for me to consider & do more research on.*
- *Allowing me to assess what I am good at and what I need to work on. This not only can help me improve in my future work life, but can also affect my social life as well. I will also be able to better understand who I am, making it much easier to find those who I connect with and careers that I can not only pursue but enjoy! Overall, understanding and including my strengths, interests, and values*

will allow me to be an independent thinker and citizen by aiding me in finding my career choices, understanding myself, and making for a better social life!

- Learning about their own characteristics and qualities (7)

- *Knowing what I'm good at and need to work on.*
- *Getting me more accustomed and more confident in what I'm doing and trusting myself that I actually know what I'm doing.*
- *Me knowing myself and knowing what I'm good at and what I need to work on.*
- *Knowing what I am good at and what I need to work on.*
- *Inspiring me to do things I love to do.*
- *Knowing what I like and what I don't so it can help me make decisions.*
- *For knowing how well I will do in different subjects.*

- Particular kinds of help (6)

- *Helping me understand who I am as a person and figuring out how to apply that to my daily life.*
- *Enabling me to work well with others and solve hard problems.*
- *Making me more confident and reminding me to always follow my dreams.*
- *Being proactive, helpful, memorial, good humor.*
- *Allowing me to complete tasks in a better way.*
- *Taking notes.*

Table 5B: Number and Percent of Students' Responses Connecting SIVs to Their Future

SIVs and the Future (n = 40)		
	Number	Percent
Finding a suitable, enjoyable career	27	68%
Learning about their own characteristics	7	18%
Helps me with…	6	15%

Students' Pre- Camp Experience and Post-Camp Comfort with Qualcomm World of Work

Table 6A shows students' prior knowledge of the activities covered during the Qualcomm World of Work. 8% of these girls had no opportunity to learn about these concepts. Although half of the girls have used an engineering design process, only 38% said they have learned about the Internet of Things.

Table 6A: Number and Percent of Pre-Camp Experiences with Qualcomm World of Work*

Have…	Pre-Survey Experience (n = 40)	
	Number	Percent
Learned about SIV	33	83%
Explored careers available at large tech companies	15	38%
Learned about IoT	12	30%
Used engineering design process	22	55%
No Opportunity	3	8%

*Students could select all that apply

Table 6B shows that after attending camp, many students expressed a great deal of confidence in different aspects of the Qualcomm World of Work activities such as being better able to identify their own SIVs, and having confidence in using their SIVs to assess future education and careers. Also, 88% of the students said they were "very confident" or "confident" in designing an IoT invention, and 95% were "very confident" or "confident" in using an engineering design process.

Table 6B: Number and Percent of Post-Camp Confidence with Qualcomm World of Work*

After attending camp…	Very Confident		Confident		Slightly Confident		Not Confident	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
I am better able to identify my strengths, interests and values.	31	80%	7	18%	1	2%	0	0
I am confident in using my strengths, interests and values to assess my future education and careers.	31	80%	7	18%	1	2%	0	0
Confident in designing an IoT invention.	19	49%	15	39%	5	12%	0	0
Confident in using an engineering design process.	23	59%	14	36%	2	5%	0	0

*Students could select all that apply n = 39

Furthermore, at the end of camp, students responded to few extra questions. For instance, they showed that 100% showed a varying degree of confidence in understanding tech companies such as Qualcomm (see Table 6C). All those who responded to the post-survey (39 out of 40) gained a confidence in understanding the role IoT plays in changing the world. This is a great understanding as only 30% of the students at the pre-survey mentioned they had previously learned about IoT.

Table 6C: Number and Percent of Post-Camp Confidence with Internet of Things and Tech Companies (n = 39)

	Very Confident		Confident		Slightly Confident		Not Confident	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
I understand what Qualcomm or similar companies do.	20	51%	16	41%	3	8%	0	0
I understand how IOT is changing our world.	25	64%	11	28%	3	8%	0	0

Students' Pre- Camp Experience and Post-Camp Comfort with Engineering Activities

Students were asked to identify whether they had previously experienced engineering activities. Six students (15%) had no previous opportunity to do any engineering activity. Interestingly, three fourths of the students had coding and programming experience before camp, and over 60% had designed and built an invention before and created a circuit (see Table 7A). Table 7B shows that by the end of camp, 95% of students felt either "Very confident," or "Confident" in making a circuit and programming an Arduino to work an LED or Servo.

Table 7A: Number and Percent of Pre-Survey Data on Engineering Activities Experienced before Camp*

Had experience in …	Pre-Survey Experience (n = 40)	
	Number	Percent
Coding and programming	30	75%
Working with LEDs	11	28%
Working with Servos	1	2%
Connecting wires to make a circuit	26	65%
Designing/Building an invention	27	68%
Had no opportunity to do any engineering activities	6	15%

*Students could select all that apply

Table 7B: Number and Percent of Post-Survey Data on Confidence with Engineering Activities after Camp Participation*

After attending camp…	Very Confident		Confident		Slightly Confident		Not Confident	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
I am confident that I can connect wires to make a circuit.	22	56%	15	39%	2	5%	0	0
I am confident that I can program an Arduino to work an LED or Servo.	25	64%	12	31%	2	5%	0	0

*Students could select all that apply n = 39

Students Desires to Build and Create

Before and after participating in the Tech Trek Camp, students were asked whether they liked inventing, building, having creative ideas, and whether they considered themselves inventors. The most interesting result is that after camp, 88% of the students considered themselves an inventor either "Yes, absolutely" or “Quite a bit” (see Table 8). This was also a statistically significant increase from pre-survey data ($p = .006$). Furthermore, Table 8 shows that 19% more students consider that they absolutely like inventing.

Table 8: Number and Percent of Pre- and Post-Survey Data on Students' Personal Attributes

I …	Yes, absolutely!		Quite a bit		A little		Not at all	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Pre-Survey (n = 40)								
Like inventing	16	40%	16	40%	8	20%	0	0
Building	25	62%	13	33%	2	5%	0	0
having creative ideas	26	65%	12	30%	2	5%	0	0
am an inventor	13	33%	13	33%	13	32%	1	2%
Post-Survey (n = 39)								
Like inventing	23	59%	13	33%	2	5%	1	2%
Building	25	64%	12	31%	2	5%	0	0
having creative ideas	32	82%	6	15%	1	2%	0	0
am an inventor	19	49%	14	36%	6	15%	0	0

Collaboration and Group Participation

When asked about collaboration and group participation before and after camp, students showed a 21% statistically significant increase in liking to share their design ideas ($p = .003$), followed by a 22% increase in collaborating with others (see Table 9). At the post-survey, students were also asked whether they felt confident working in a team to build a robotic creation. Although the camp was virtual and they worked individually to create their hat, 95% either “Strongly agreed” or agreed with the confidence they felt in working on their creation.

Table 9: Number and Percent of Pre and Post-Camp Confidence in Collaboration with Others

I like…	Yes, absolutely!		Quite a bit		A little		Not at all	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Pre-Survey (n = 40)								
Collaborate with others	18	45%	16	40%	6	15%	0	0
presenting what I have created with others	14	35%	13	33%	11	27%	2	5%
to share my design ideas with others	10	25%	9	22%	21	53%	0	0
Post-Survey (n = 39)								
Collaborate with others	26	67%	7	18%	6	15%	0	0
presenting what I have created with others	17	44%	11	28%	11	28%	0	0
to share my design ideas with others	18	46%	12	31%	8	21%	1	2%

Inspiration Hour

On four days of the camp, the last hour was dedicated to *Inspiration Hour*. According to Hedge Company Principal consultant on AAUW project, the *Inspiration Hour* that consisted of 40-45 minutes of storytelling, followed by 15-20 minutes of Q&A, had three objectives: 1) to motivate the girls to learn more about careers in STEM, 2) to broaden participants’ perspective of engineering by inviting female figures in STEM fields. These speakers looked like them from a multitude of perspectives, including age, sex, race, and ethnicity, and 3) to provide a forum for black and Hispanic female engineers’ narratives to be heard and recorded. The

selection process was based on the speaker's characteristics: passionate, engaging, and able to connect with young girls.

During the *Inspiration Hour*, 11 inspiring professional women in STEM careers served as guest speakers to inspire the girls. At the end of the day, during the reflection time, students rated the inspiration hour in five ways: how interesting was the speaker; how interesting was the topic they discussed; did they learn anything that day that they did not know before; were they inspired to learn more about STEM, and did they feel the personal connection to one or more of the speakers?
The *Inspiration Hour* on the first day of camp was kicked off by the head of cybersecurity for Morgan Stanley who discussed basic concepts of cybersecurity. The rest of *Inspiration Hours* focused on female speakers who were either black and/or Hispanic. Guest speakers were invited from Boeing, 3M, FIRST (a technology-focused organizations), and Poway High School SWENext club (the Society of Women Engineers' SWENext program). A few of the speakers completed Intro videos on Flipgrid to share about themselves ahead of time.

In general, students gave high ratings to the speakers. On Thursday, all of the students (38 participated in the reflection that day) found the speakers either "Yes, absolutely" or "Quite a bit" interesting (see Table 10A), and only 1 student on each of the previous days gave a rating below "Quite a bit". Table 10B shows that on three days (Tuesday, Wednesday, and Thursday), more than one third of the students could personally relate to one or more of the speakers (with only 3-8% saying "Not at all"). Table 10C shows that the majority of students each day found the topic of the Inspiration Hour interesting. Furthermore, the majority of students, across days, learned something new from the presenters, either "Yes, absolutely" or "Quite a Bit"), and on Monday, that percentage was 97% (see Table 10D). Also, Table 10E shows a majority of students were inspired to learn more about STEM, and again, Monday's percentage was highest (97%). Clearly, these speakers were impactful and inspiring to the girls.

Table 10A: Number and Percent of Students Rating of the Inspiration Hour Speaker

		Yes, absolutely!		Quite a bit		A little		Not at all	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent
Monday	n = 39	26	67%	12	31%	1	3%	0	0
Tuesday	n = 40	30	75%	9	23%	1	3%	0	0
Wednesday	n = 36	24	67%	11	31%	1	3%	0	0
Thursday	n = 38	34	90%	4	11%	0	0	0	0

Table 10B: Number and Percent of Students Who Personally Related to the Inspiration Hour Speaker

		Yes, absolutely!		Quite a bit		A little		Not at all	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent
Monday	n = 39	5	13%	13	33%	19	49%	2	5%
Tuesday	n = 40	14	35%	13	33%	12	30%	1	3%
Wednesday	n = 36	12	33%	12	33%	11	31%	1	3%
Thursday	n = 38	14	37%	13	34%	8	21%	3	8%

Table 10C: Number and Percent of Students Rating of the Inspiration Hour Topic

		Yes, absolutely!		Quite a bit		A little		Not at all	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent
Monday	n = 39	27	69%	11	28%	1	3%	0	0
Tuesday	n = 40	32	80%	8	20%	0	0	0	0
Wednesday	n = 36	25	69%	9	25%	2	6%	0	0
Thursday	n = 38	30	79%	8	21%	0	0	0	0

Table 10D: Number and Percent of Students Learning Something New from Inspiration Hour Speaker

		Yes, absolutely!		Quite a bit		A little		Not at all	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent
Monday	n = 39	32	82%	6	15%	1	3%	0	0
Tuesday	n = 40	26	65%	8	20%	6	15%	0	0
Wednesday	n = 36	20	56%	10	28%	5	14%	1	3%
Thursday	n = 38	29	76%	6	16%	3	8%	0	0

Table 10E: Number and Percent of Students Who Were Inspired to Learn More about STEM from Inspiration Hour

		Yes, absolutely!		Quite a bit		A little		Not at all	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent
Monday	n = 39	22	56%	16	41%	1	3%	0	0
Tuesday	n = 40	25	63%	11	28%	4	10%	0	0
Wednesday	n = 36	21	58%	11	31%	4	11%	0	0
Thursday	n = 38	29	76%	5	13%	4	11%	0	0

Problem-Solving Skills

Another point of interest is the development of problem-solving skills by students. Although students identified that they know how to overcome challenges and how to learn new things even when they are making mistakes, the impact of camp was particularly observed in figuring out how to fix things that do not work, and how to solve technical problems (see Table 13). There was a 24% increase in students' responses who absolutely thought that they knew how to overcome problems. This increase was statistically significant ($p = .010$). Also, there was a 29% statistically significant increase in the percentage of students who absolutely thought they knew how to solve technical issues ($p < .001$). Finally, at the post-survey, 93% of the students were "Yes, absolutely," or "Quite a bit" comfortable asking for help when needed, and this was statistically significant compared to 78% who felt the same at the pre-survey ($p = .010$).

Table 11: Number and Percent of Pre- and Post-Survey Data on Students' Problem-Solving Skills

I know…	Yes, absolutely!		Quite a bit		A little		Not at all	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Pre-Survey (n = 40)								
how to overcome challenges	19	48%	20	50%	1	2%	0	0
how to figure out to fix things that don't work	10	25%	26	65%	4	10%	0	0
how to solve technical problems	6	15%	22	55%	11	28%	1	2%

how to learn new things, even if I make mistakes.	30	75%	10	25%	0	0	0	0
I am comfortable asking for help from others when needed.	18	45%	13	33%	9	23%	0	0
Post-Survey (n = 39)								
how to overcome challenges.	20	51%	19	49%	0	0	0	0
how to figure out how to fix things that don't work.	19	49%	18	46%	2	5%	0	0
how to come up with ways to solve technical problems.	17	44%	17	44%	5	13%	0	0
how to learn new things, even if I make mistakes.	32	82%	6	15%	1	2%	0	0
I am comfortable asking for help from others when needed.	26	67%	10	26%	2	5%	1	2%

Pre- Camp Engineering Exposure & Post-camp Desire for After-School Clubs

Students responded to a few questions regarding whether they had attended any out-of-school activities in robotics, coding, science, or engineering camp. Although 20% had no previous participation in any kind of technology or engineering camp, Table 12 shows that over half of the students had participated in robotics engineering, coding, or science camps.

Table 12: Number and Percent of Participation in Engineering, Robotics, and After-School Science Clubs*

Participation in the following programs	Pre-Survey (n = 40)	
	Number	Percent
Robotics	21	53%
Coding and programming	17	43%
Engineering	18	45%
Science	22	55%
No Clubs or after school experience	8	20%

*Students could select all that apply

Pre- and Post-Camp Interest in Taking Advanced Courses in High School

When students were asked about their desires to take advanced STEM courses in high school at pre- and post-survey, the results clearly indicated students' interest in selecting more advanced STEM courses after camp. In fact, after the Tech Trek, students who were “Yes, absolutely” interested in taking engineering/robotics courses had a statistically significant increase of 31% ($p < .001$). Also, there was a 16% statistically significant increase for those who said “Yes, absolutely” they were interested in taking computer science courses ($p < .001$). For the interest in taking advanced mathematics courses, there was a 19% statistically significant increase ($p = .006$).

Table 13: Number and Percent of Pre and Post-Survey Data on Confidence with Enrolling in Advanced Math, Science, or Engineering Classes*

I am interested in …	Yes, absolutely!		Quite a bit		A little		Not at all	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Pre-Survey (n = 40)								
Computer science	5	12%	14	35%	15	38%	6	15%
Advanced-level mathematics	23	58%	10	25%	4	10%	3	8%
Engineering/Robotics	9	23%	18	45%	11	28%	2	5%
Advanced-level science	24	60%	16	40%	0	0	0	0
Design classes (graphic design, 3D modeling, etc.)	17	43%	12	30%	9	22%	2	5%
Post-Survey (n = 39)								
Computer science	11	28%	15	39%	13	33%	0	0
Advanced-level mathematics	30	77%	4	10%	3	7%	2	5%
Engineering/Robotics	21	54%	13	33%	4	10%	1	2%
Advanced-level science	23	59%	14	36%	2	5%	0	0
Design classes (graphic design, 3D modeling, etc.)	19	49%	13	33%	7	18%	0	0

*Students could select all that apply

Plans for After High School Graduation

There was no change in students plan for after high school graduation as 98% chose to attend a 4-year college and 2% to attend a 2-year college. However, it is interesting to note that when the students were asked at the end of camp what college major they were considering if they planned to continue their education, of the 39 students responding to this question, 88% (34 out of 39) specified their intention to pursue a STEM-related major, with the main fields being medicine, biology, and engineering, or other STEM-related fields. Of the remaining 5 students, 3 had not decided what to study yet, and only 2 students specified a non-STEM field, from whom one selected drama/art, but the other said: "At the moment, I plan to study business in college in hopes of becoming a Lawyer or Government Affairs Specialist. But although that has always been my dream, Tech Trek has opened my eyes up to many other STEM careers that may change my path in the near future" (see Table 14).

Table 14: Number and Percent of Post-Survey Data on Students' College Major Selection

	Post Survey College Major (n = 39)	
	Number	**Percent**
Medicine	10	26%
Biology	9	23%
Engineering	8	21%
Other STEM	7	18%
Non-STEM	2	5%
Do not know	3	7%

Opinions on Camp

At the end of camp, students were asked whether they will participate in the camp again and whether they will recommend it to others. 98% said yes, they will take it again and all (39 who responded to the post-survey) said they will recommend it to others.

Suggestions for Camp Improvements

On the post-survey, when students were asked for their suggestions on how to improve the virtual camp, 20% of students (8 out of 40) simply said they had no suggestions. The rest were split evenly between making suggestions and offering praise for the experience. The main categories of suggestions were for adding more content like the engineering design process or Arduino, and for providing additional time, primarily for building. Students' praises for camp was enthusiastic and appreciative.

Table 15: Number and Percent of Students' Suggestions for Camp Improvement

	Suggestions for Camp Improvement	
	Number	**Percent**
Additional Content	4	9%
Additional Time	4	9%
Logistic Issues	8	21%
Praise for Camp	16	41%
No	8	20%