Factors That Inspire Youth to Pursue STEM Pathways in San Jose, California

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Abstract

This project is a collaboration between San José State University (SJSU) and The Tech Interactive (The Tech) in San José, California. In an effort to create and expand programming and spaces that are inclusive of gender identities, The Tech and I sought to examine their yearly Tech Challenge (TTC) to understand their participants. Overwhelmingly, the young women and men interviewed had similar sentiments in having role models in their life that inspired them to pursue STEM. Though in comparison to their male counterparts, young women were more motivated by internal factors such as altruism. Young women had a broader range of interests in STEM careers with mentions of pursuing computer science, biology, and aerospace. Additionally, young women more often mentioned negative experiences in spaces related to STEM. Recommendations that arose from the research gathered, related to the need for The Tech to further develop their current mentoring program, a pathway into a program related to STEM for alumni of the TTC, and informational STEM fairs.

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CHAPTER ONE

PROJECT DESCRIPTION

Introduction

In this project, I had the honor to partner with The Tech Interactive (The Tech) and its staff to understand gendered experiences related to STEM (Science, Technology, Engineering, Mathematics) aspirations. With intentions of expanding their museum space, The Tech sought to incorporate more gender inclusive programming and resources to create a safe space for the local community. Since The Tech Challenge (TTC) is one of their most historically gender diverse programs, they wanted to get more insight into the personal experiences of those who choose to participate. Over the span of a few months, I worked alongside Tech staff interviewing 24 participants on their interests, career aspirations, and experience with The Tech Challenge. My goals were to identify what factors influence TTC participants to pursue STEM and how these factors might differ between young women and men.

The Tech Interactive is a renowned science and technology learning center in downtown San José, CA. Their mission is to "inspire the innovator in everyone," through educational science and technology exhibits that allow young people to visualize science on a large interactive scale. Programs like The Tech Challenge prompt teams of 4^{th}-12^{th} graders to engineer devices for real-life applications and issues. Another program they offer, The Tech for Global Good, is a way to honor inspiring altruistic innovators by noting their accomplishments on their museum website. Located in Silicon Valley, The Tech aims to inspire future technological success by providing children with a glimpse of the future by letting them interact with the technology and science of the present.

Women are still largely absent in STEM fields such as physics, engineering, and computer sciences (Cowgill 2021, 62). The lack of diversity in the field tends to be the result of systematic barriers caused by historically exclusionary cisgendered heterosexual perspectives built into STEM pathways. The lack of gender diversity in STEM then impedes design as there is a deficit of diversified perspectives and increase in socioeconomic inequalities (Ashcraft 2017, 233). Women being nearly absent in STEM in turn has made entering the field for people from non-cisheteronormtaive experiences more difficult. Moreover, it is important to examine teenage experiences with STEM to identify which factors contribute to STEM career aspirations. Teenage girls, especially from ages 11 to 14, begin to decline in STEM interests and career interests (Chen et al. 2022, 3). Overcoming the gender gap in STEM then requires an effective understanding of factors that deter and motivate aspiring teenage girls and other minoritized identities to engage in STEM career pathways.

I partnered with The Tech due to my interests in conducting research related to the promotion of gender inclusivity and creating welcoming spaces for minoritized identities. I had the honor of working with people from the Inclusivity Research and Development (IRD) team with assistance from The Tech Challenge team. Due to the persisting concerns surrounding COVID-19 and scheduling conflicts, we collaborated more predominantly online though Zoom where we developed survey questions, discussed programming at The Tech, and interviewed participants. This introductory chapter discusses the process of collaborating with The Tech and the development of my approach to examining factors related to STEM aspirations and the gender differences that exist within them. Additionally, this chapter reviews the general project plan and discusses the literature that guided the analysis.

Partnering with The Tech Interactive

Inspired by personal interests in media representation and video games, my interests were originally set on exploring the experiences of streaming for women in gaming. Frequently I heard stories of women being harassed on streams in comparison to their male counterparts. Drs. A.J. Faas and Jan English-Lueck, were supportive of the project's intention but were concerned with the application of the project due to past experiences in collaborating with major streaming platforms. Instead, Dr. Faas advised collaborating with The Tech Interactive due to the San José State University's Applied Anthropology's past work with them and their interests in research about gender inclusivity. Dr. Faas and Dr. English-Lueck had reshaped my perspective, challenging that the gendered issues that existed on streaming platforms are due to the lack of women and minoritized identities behind the creation of them. If I were to examine educational STEM venues, I could be contributing to the creation of programs reflective of the experiences of women and minoritized identities. The Tech was interested in my work due to an upcoming expansion of their museum space and with-it intentions to expand their resources to support gender inclusion. After a month of discussions, the IRD team thought my research would be best applied to an analysis of the gendered experiences of The Tech Challenge. Since The Tech Challenge is one of The Tech's most gender diverse programs, they saw potential to examine its participants and their interest in the program. Contributing to The Tech's research for gender inclusivity can assist in the elevation of personal experiences of San Jose youth and the creation of more accommodating resources for a diverse range of gender experiences.

Gender Inclusivity: Thinking about Gendered Experiences

While conducting the research of the factors of influence in the pursuit of STEM and the different gendered experiences of TTC participants, I was mindful to utilize the concepts of

intersectionality, self-efficacy, and culturally responsive pedagogy. Intersectionality is utilized to keep myself mindful of the interplaying factors within participant experiences. Self-efficacy served as a reminder that personal expectation and value are large influences on participant interests. Culturally responsive pedagogy assisted in my consideration of recommendations regarding the local experiences of participants to program development.

Intersectionality

Gender serves as one of the many factors that can alter participant encounters with STEM, being mindful of the interconnected experiences that may result from gender interplaying with personal interests, environmental influence, and familial support. Intersectionality can assist in addressing systematic inequalities while being mindful of the power dynamics and privileged experiences that reinforce them (Longman and Graeve 2014, 37). Additionally, the bias I have as a researcher can be challenged with mindful reflection of the intersectionality of participant experience and interest. In consideration of methodology, intersectionality supports the consideration of various levels of bias and experience, which may occur during the interview process, participant experience, and analysis (Lutz 2015, 40-41). With the project's emphasis on gender experiences, intersectionality can serve to consolidate the validity of identity experiences and highlight the multi-dimensionality of participant experiences.

Self-Efficacy

While analyzing the factors that may influence participants to pursue STEM, it is integral to my research to keep in mind that participants are ultimately driven by their own sense of accomplishment. Self-efficacy as a concept provides a methodological focus on the individual, in light of the outside factors that should alter their interests in STEM careers. In relation to environmental factors, self-efficacy in STEM is predictive of their interactions with teachers,

peers, and family (Tzu-Ling 2019, 1871). Acknowledging that internal and external factors may influence participant experiences with STEM in tandem with their self-confidence is important to quantifying their experiences and analyzing their responses. A student's sense of capabilities in STEM tends to have a positive association with self-efficacy and STEM career interests (Marriott et al. 2019, 15). When analyzing interviews, self-efficacy can provide consideration to participants' expectations and values of self in relation to STEM interests.

Culturally Responsive Pedagogy

Culturally relevant pedagogy can be defined as the use of learning concepts of cultural knowledge that is relatable and meaningful to learners (Young et al. 2019, 10). The research conducted can reflect a cultural pedagogy in how participants engage with STEM based on their personal backgrounds. Being aware of culturally relevant pedagogy, can inform my research analysis and recommendations based on potential overarching themes on how participants engage with STEM. The main objective of culturally responsive pedagogy is to overcome traditionally exclusionary school learning and create learning content that is reflective to all student experiences (Ashcraft et al. 2017, 235). Additionally, by analyzing the local patterns of how TTC participants experience STEM, my research can further assist in The Tech's inclusive community and space building.

Methodology

After the IRD team decided my research should focus on The Tech Challenge, I worked with staff from The Tech and my committee chair, Dr. Melissa Beresford, to work on an effective research design for the participants I would be analyzing. A drawing experiment and analysis were first pitched to The Tech with inspiration from Dr. Beresford's prior work, entailing participants to draw what STEM and success meant to them. However, The Tech was more

interested in personally understanding their participants and felt having participants draw would not provide them with the information they were seeking. Ultimately, The Tech and I agreed on a brief interview with questions pertaining to their interests, exposure to STEM, experience with The Tech Challenge, and their plans moving forward. The original drafts consisted of questions pertaining to their performance in school and how they would rate their STEM identity but were removed out of concern of making participants feel uncomfortable and confusing them.

When considering how to recruit participants, Director of the IRD Team Prinda Wanakule and IRD Project Manager Lisa Incatasciato discussed with TTC Program Manager Leah Koldewyn. In response, Leah had the TTC team reach out to recent TTC participants with an email detailing the study and a link to an interest form. After the engagement with the first email dropped, the TTC team then sent out emails to old team advisors asking them to reach out to old participants they mentored. Though the study was originally supposed to examine the experiences of nonbinary youth in addition to young women and men, no nonbinary individuals applied to participate in the research study. Additionally, due to a lack of engagement from young men the data represented shifted from an even 12 of each group to 14 young women and 10 young men.

Upon completing the interest form, TTC participant email information was placed in a lottery then chosen randomly according to the required gender representation. When a participant was chosen, they were sent a follow up email thanking them for their interest along with a links to a consent form and a Calendly, where they could schedule a day to meet with myself and a Tech Interactive employee over Zoom. If requested, a participant was sent a copy of their consent form for their personal reference prior to their chosen interview date. On the day of the interview one of the three; IRD Project Manager Lisa Incatasciato, Community Coordinator Jhaid Parreno,

or Evaluation and Prototyping Studio Coordinator Clarissa Buettner, and myself were present due to museum protocol. Prior to all interviews, it was verified that the participant had completed the consent form consisting of theirs and a guardian's signatures followed by a consent notice that confirmed the participant was comfortable with being recorded. Interviews lasted an average of 18 minutes; among young women it was 21 minutes and among young men it was 14 minutes.

After the interview was completed, the Zoom recording was downloaded onto a password protected laptop then uploaded to Otter. Ai for audio transcription. If requested, a participant could be given a copy of the interview transcription or video and audio recording for personal reference. All the information gathered from the participant (age, grade, school of attendance, email, etc.) was compiled into a secure Excel spreadsheet for my personal reference only. After transcription was completed and reviewed for errors, pseudonyms were assigned to the participants to ensure anonymity.

Project Goals

The main goal of the project is to gather and analyze data related to assisting The Tech Interactive's STEM Career Pathways User Journey Mapping Project. The research of this project aims to aid The Tech by utilizing applied anthropological theory and methodology to examine the gendered experiences of participants of The Tech's "The Tech Challenge" Program (TTC). In line with the objectives of The Tech, I proposed two research questions that will identify and address the factors that shape the experiences of STEM in informal educational spaces.

I. What factors are influencing TTC participants to pursue STEM careers in comparison to those who are not?

II. Are there differences in these factors, by gender identity, that influence teenage TTC participants' decisions to pursue STEM careers?

Project Deliverables

After first completing initial data collection, I created a Google Slides of my preliminary findings noting a brief overview of demographics and arising themes among participants. I then presented my preliminary findings to various staff at The Tech and provided recommendations based on participant experiences. The final deliverables of the project consisting of a detailed report of my findings and an updated Google Slides summarizing the data collected will be provided to The Tech upon completion. Additionally, I will be presenting my research to various staff at The Tech and having discussions with them about my program recommendations. The Tech will then have access to all the mentioned deliverables at their disposable for program revision and resource development.

Roadmap

This project report is divided into three chapters. Chapter 2 is in article format for future publication that briefly overviews the results of the study in a digestible summary of key findings. I discuss the factors of influence participants experienced that ultimately inspired their interests in pursuing STEM in the future and the major gender differences between them. In Chapter 3, I conclude with a reflection of the project outcomes, anthropological impact, and recommendations for further applied research in inclusivity programming.

CHAPTER TWO:

THE TECH CHALLENGE AND STEM PATHWAYS

Abstract

This study examines what factors motivate adolescents to pursue STEM careers within the context of their experiences within "The Tech Challenge." The study is a collaboration between San José State University (SJSU) and The Tech Interactive (The Tech), a science and technology learning center in San José, CA. With interests to make their programming more inclusive, The Tech wanted to conduct a study of their yearly The Tech Challenge with intent to understand participant experiences. Tech Interactive staff and I conducted twenty-four online interviews with a total of fourteen young women and ten young men. We asked participants questions regarding their future plans and motivations for pursuing STEM careers then created a list of factors from those cited by them. Two categories of influence were developed as result of participant responses: internal (natural propensity, altruism, gratification) and external (finance, environment, role model). In addition to motivational factors, we sought to analyze any potential difficulties that existed between gender groups. However due to the skew of gender representation, minor differences were found. Young women were more likely to be motivated to pursue STEM due to internal factors and mention negative experiences in STEM spaces.

Keywords: STEM careers, factors of influence, STEM motivation

Introduction

San Jose, CA sits in the center of Silicon Valley, an international epicenter of technological advancement and unparalleled expectations of STEM achievement. For years, people have flocked to Silicon Valley with hopes to lead the forefront of technological innovation. With the rapid evolution of technology and science, STEM has become central to the U.S. economy. Beyond the U.S., international governments are attempting to foster educational environments that provide students skills for STEM careers in response to the growing importance of the field (Black et al. 2021, 1). As STEM becomes a significant source of societal development, it is important that educational institutions capitalize on youth

interest. Thus, it is important for non-academic institutions to learn what motivates youth to engage with STEM so that they can bolster engagement and develop career pathways.

Informal learning environments can enable youth to experiment in a non-judgmental space and provide underrepresented communities the chance to engage with STEM (Campana, Mills, and Martin 2018, 765). The Tech Interactive (The Tech) focuses on promoting technology and science learning amongst the diverse communities in San Jose, California. As a public learning venue, the Tech is interested better understanding the experiences of the youth who engage with their programming with the goal of using that knowledge to provide high-quality support and resources for local communities in San Jose. One of The Tech's objectives is to incorporate more gender-inclusive spaces and resources that are accommodating to a diverse range of gender identities. Their concerns arise as a result of historical systematic barriers that tend to exclude young women and various minoritized identities. Women are still largely absent in STEM fields such as physics, engineering, and computer sciences (Cowgill 2021, 62). As a result, diverse gender experiences are barred and discouraged from engaging in STEM pathways. The lack of gender diversity in STEM then impedes design as there is a deficit of diversified perspectives and increase in socioeconomic inequalities (Ashcraft 2017, 233). In collaboration with The Tech, I conducted a study on their program, The Tech Challenge (TTC), that prompts students in grades 4-12 to solve a real-world problem over the course of a few months. With interest from The Tech to understand the participants of TTC, I proposed two questions: what factors are influencing TTC participants to pursue STEM careers, and if they are, what differences in these factors exist based on gender identity.

Study Background – The Tech Challenge

The Tech Challenge (TTC) is a yearly engineering design challenge open to teams of students from 4th to 12th grade (Tech Interactive 2023). Teams consist of 2-4 students with one advisor (who must be at least 18 years of age) whose responsibility is to ensure they're safe and staying on track. The prompt changes every year with an emphasis on real-life applicability so students are given the opportunity to try "real-life" engineering design (Tech Interactive 2023). Some of the prompts from the prior years include The Ultimate Upscale (2021), where teams had built a new device out of cardboard and Kinetic

Commotion (2022), where teams had to create a device that used stored energy to create sound. Students are given roughly 5 months to engineer a device that meets the prompt's distinct requirements and asked to showcase their final design in April. Teams are scored based on how they documented their engineering process, their presentation and responses to judges' questions, and their sense of teamwork. After all teams have tested their devices, those who performed best overall depending on grade level are announced along with judges' mentions awards.

Research Methods

Intent: The goal of this study was to understand the factors that influence adolescents' desires to pursue STEM careers and assess if there are any differences in these factors across genders.

Sampling

Recruitment and sampling were conducted by The Tech, specifically The Tech Challenge team lead by Program Manager, Leah Koldewyn. They sent over 350 emails to advisors of TTC teams from 2020-2022. Advisors were asked to reach out to any past participants who were of middle school through high school age. They were informed the study would entail discussing their interests, hobbies, and experience with the TTC (all people recruited were offered a $25 Amazon gift card for their participation). With intentions to analyze gender differences, twelve young women and twelve young men would be randomly chosen for the study. Originally, the study also sought to look at non-binary experiences, but no non-binary participants responded to our survey. Of the emails sent out to over an estimated 1,000 participants, 37 responses were collected with 25 identifying as young women and twelve identifying as young men. Of the twenty-five young women that responded, they were assigned a number then twelve were randomly chosen to be sent a follow-up email. All twelve young men that responded were sent a follow-up email. As a result of young men not responding to our follow-up email, more young women were chosen in their stead leading to fourteen young women participating in the study. The participants chosen for the study were emailed links to a consent form for demographic information and a Calendly to fill out with a date they were available to interview. Participants were then emailed a Zoom

link for their chosen date. Ultimately, twenty-four participants, fourteen young women and ten young men, were recruited with help from The Tech Challenge Team.

Data Collection

Interviews took place over Zoom, conducted by myself in the presence of a Tech Interactive employee due to museum regulations. The interviews focused on participant hobbies, STEM experiences, TTC experiences, and their plans moving forward. Questions included: Do you participate in any STEM-related hobbies/activities? How have you been exposed to STEM in a school setting? What motivated you to participate in The Tech Challenge? What are you planning to do moving forward? Interviews lasted roughly 20 to 40 minutes and were transcribed using Zoom's AI automated transcription. After the interview was downloaded onto my laptop, the audio was then uploaded to Otter AI to be checked and corrected for accuracy.

Data Analysis

After the interview audios were corrected accordingly, they were uploaded into MAXQDA for analysis. The interviews were divided into male and female groupings to account for any potential gender differences. Demographics were coded first, making note of the different schools who participated in the study. Hobbies followed, with interest in noting any correlation between personal interest and a potential future in STEM. Themes were derived through in-vivo coding, which entailed creating codes by reviewing the interviews for significant differences and similarities. As such the categories for factors of influence were derived based on how frequently a topic was mentioned. As an example, participants had discussed a person in their life that influenced them to pursue STEM 28 times, leading to the creation the category "Role Model." The creation of internal and external factors was a result of participants referring to factors that related to personal desires and outside influence.

Study Findings

Upon reviewing all 24 interviews that ranged from twenty to fifty minutes, differences in adolescent motivations to pursue STEM careers were evident—from their hobbies and personal interests to their candor in speaking with us. However, across all of the interviews 6 factors that influenced TTC

participants to pursue STEM in the future (of those interested) were apparent. Additionally, I discovered two different major categories of factors: internal and external. Internal factors are related to participants' personal interests and desires to pursue STEM with little or no mention of elements outside their person. Internal factors are frequently mentioned in the context of "I" statements such as "I enjoy robotics" or "I like coding." Internal factors included the categories of (a) Natural Propensity, (b) Altruism, and (c) Gratification. External factors are related to participants' relationships with outside influences that have shaped their own goals and desires. Participants typically cited external factors in statements pertaining to a subject that has affected a participant in some way like "My parents did this, so I did" or "The salary motivated me." External factors included the categories of (a) Finance, (b) Environment, (c) Role Model. Though despite the distinction of the internal and external factors, very frequently participants cited two different reasons for pursuing STEM which tended to be from both kinds.

Internal Factors

Natural Propensity

Derived from a participant's interview, natural propensity refers to a participant's natural talent at conducting an action which in the case of the study referred to STEM in some form. Two students, a young woman and man, claimed they were joining a field because they found it easy to do in comparison to another field. The young man stated that pursuing computer science was more appealing because he felt "it's a lot easier to create stuff on the computer, then it is to create stuff in real life." Similarly, the young woman found she had stumbled into her natural talent for robotics and saw it as field she "something that I actually really enjoyed doing." Interestingly, the distinction between them existed in their intentions with their natural talent as a venue of a career. Though the young woman saw her natural talent as a pathway into a career, she also seemed to discuss it as a backup plan, stating "But like, if I don't hate it, and it pays well, like I might as well do it. And then I can have like...a budget to like, pursue whatever hobbies I want to in my free time." In comparison to the young man, she seemed to be more pragmatic about her chances of enjoying her future career and emphasized that fulfillment could always be pursued outside of it.

Altruism

Of the four participants that referenced wanting to "help" in some capacity in their career were all young women. All of them seem to discuss their sense of altruism, in that they wanted to contribute to a greater cause outside of themselves. One young woman was thinking of pursuing genetic engineering as a means to help people with conditions that hinder their living circumstances, stating "And I just feel like if we're able to find those problems early on, they can live so much happier and so much healthier for the rest of their lives." Another young woman found interest in becoming a bioengineer because she watched a movie and thought "…Okay, I want to do this, this guy's helping so many people." Even in cases where the young women weren't sure what aspect of STEM they would pursue in the future, they were always certain they wanted to help others. As one young woman who wanted to pursue the medical field stated, "…I, from a young age, I knew I wanted to help people. I just didn't know how I would." She continued to add she had a special interest in aiding developing countries with issues of poverty and malnourishment. A common theme between most of the young women who wanted to "help" is that they either weren't sure in what capacity they would help or felt being in the medical field would be the best form of accomplishing that.

Gratification

Seven participants, five young women and two young men, referred to personal gratification or enjoyment of STEM as their reason for pursuing it as a career. Overall, the participants mentioned in some capacity that they genuinely enjoyed practicing STEM or found it interesting to pursue. Though participants varied in their expression of gratification such as finding coding as a fun hobby or learning about biology as interesting, they all wanted to pursue STEM out of personal enjoyment. As one young lady stated with interest in pursuing pharmaceutical botany, "Uh, I think it was I just really started like enjoying like looking at plants and figuring out what was wrong with them. And then after being able to save so many plants, I was like, oh, cool, maybe I should like look into like the study of plants." In some cases, even though participants had found out about a STEM career from an external factor, they still found themselves coming to enjoy the subject in question. One participant had found out about

anesthesiology through a relative and stated, “I've been interested in like anesthesiology, because like my aunt, an anesthesiologist. And she, like, showed me some stuff. And I thought that was like, pretty interesting.” Fascinatingly, the young women who found gratification a factor of pursuing STEM weren’t necessarily engaging with it outside of career interests. In comparison to their male counterparts, the young women seem to pursue a wide variety of hobbies outside of STEM like athletics, art, literature, learning, and video games.

External Factors

Finance

Similar to natural propensity, only two participants, a young woman and man, stated that financial compensation for their work was a factor in pursuing a STEM career. The young man seemed to mention the amount of pay in passing but still found it important to mention in his interview. In reference to the air force, he stated, “So if, after a certain amount of time, you can basically automatically get into air, into the Air Force. And you'll have a higher fee or a higher pay wage.” In comparison, the same young woman who saw her natural talent as a backup plan, argued that her pay could serve as a way to get enjoyment outside of her career path similar to her male counterpart. Surprisingly, very few participants outwardly mentioned pay as a major factor in pursuing a STEM career. In the instances where pay was discussed, participants emphasized that though pay would be good it wasn’t their main reason for pursuing the STEM field.

Environment

Three participants, two young women and one young man, stated that their environment played a role in their pursuit of a STEM career. All of the participants mentioned that the outside environment had shaped their decision to enter the STEM field in some capacity. The one young man stated that his exposure to STEM and engineering as a child led to him wanting to pursue an engineering degree in college. Similarly, one of the young women stated that her presence in Silicon Valley influenced into pursuing STEM, stating “…. depending on where you live, with, like, Silicon Valley being like the hub for STEM, like everyone's just like STEM, STEM, STEM, STEM.” Though the other young woman did

not want to pursue STEM outright, she felt opportunities available to her, she wasn't qualified for, stating "Um, I guess, like, I've applied to, like, some opportunities before, but most of them, like when I look through them, they require a lot of, like, knowledge on like, software related stuff, or like they have a lot of requirements. So, I want to like learn more, so I can like actually fulfill those requirements." Though only three participants brought up their environments as influences in potentially pursuing STEM, they were still mindful of Silicon Valley's nature of their experiences.

Role Model

Ten participants in total, six young women and four young men, cited a role model in their life that inspired or influenced their pursuit of a STEM career. Of the factors, a person in their life that had inspired or influenced participants to pursue STEM was cited the most frequently. Staggeringly, role models were typically family members who were or are STEM professionals in the field that introduced participants to their work. Additionally, even when parents were not in STEM, they in some capacity supported participants to pursue STEM. Parents would support participants by enrolling them in STEM courses or buying them activity kits related to STEM learning. As one participant stated in her attempts to find a career pathway in the health field, "So I started to do more research into that. My mom put me in a couple of courses, like honors biology courses and things. So, it was definitely like, a sudden thing that happened." In other cases, participants were inspired to pursue STEM by interactions with educators and watching content creators. One young woman talked about how her science teacher was her role model and how he supported her endeavors in pursuing biology by gifting her book she always borrowed in class, "…at the end of the school year, he told me, I could just have it because he had so many copies um, at home." One young man discussed a Youtuber as one of his main inspirations for pursuing engineering, stating, "Right, so one of my main inspirations, Mark Rober. I've been watching his videos for so long. And the way he explains things, the way he makes it, everything and science seem really fun. Uh, it made me want to get into it." Though participants didn't have the same role model experience, across the board their interactions with them seem to mean a whole lot if not everything in their pursuit of STEM.

Career Interests

In discussions about their interests and future endeavors, participants were asked what they thought they would be doing in the future however they chose to interpret it. Most of them did have a goal in mind and even in the instances participants were unsure, most had a general idea where to begin searching for one. A majority of participants reported with full certainty that they wanted to pursue a career in STEM. Even of the few participants who weren't sure, most of them still felt they were likely to major in STEM upon entering college. The young women were more spread out in their career interests with STEM and non-STEM pathways. Overwhelmingly, young women gravitated towards biology in comparison to the young men who were more interested in engineering. Though the most interesting is that none of the young men were interested in pursuing biology even though some of the girls were interested in engineering. As previously mentioned, the young women were also more likely to discuss a "backup plan" with one mentioning that if the field she pursued didn't "work out" she would just pursue another one.

Discussion

Internal Factors

In line with the proposed research questions, TTC participants are influenced by two forms of factors: internal and external. Internal factors were divided into three categories: natural propensity, altruism, and gratification. Of the internal factors mentioned, natural propensity was referred to the least among participants. When participants discussed their natural propensity for STEM, they recognized their innate efficiency in the field and saw it as a pathway into a career. When students feel a sense of self-efficacy when searching for career opportunities, they're more likely to persist in STEM (Cabell 2021, 162). Though the participants that had mentioned natural prosperity didn't agree on their enjoyment of a STEM career, it still served as a pushing force for them to consider a future in the field. Due to the participants' sense of self-efficacy in STEM, their beliefs that they could succeed and persist in the field were reinforced. How students perform in STEM can transform their sense of self-accomplishment in their ability to succeed in the field and whether they stay (Marriott et al. 2019, 2). The creation and use of

programs that support experiences that allow students to showcase their STEM learning can help bolster students' self-efficacy and retention in STEM.

Altruism was discussed in the context of utilizing STEM to contribute to a greater cause such as world change and generally helping others. When participants expressed an interest in altruism, they consistently described STEM as a venue for effectively practicing it. Interestingly, all of the participants that had mentioned altruistic activities were all young women. It may be that due to societal expectations the participants had internalized the gender expectation that women are innately to be altruistic. Additionally, it may be that the young women in the study happen to be more inclined to altruism. Women tend to be more attracted to STEM when they see percieve it as a way of helping others which could be related to the psychological benefits related to it (VanLeuvan 2010, 250). However due to the skew of the gender representation it may be that none of the young men who were part of the study didn't feel altruism was a factor in their pursuit of STEM. In response to utilizing altruism to bolster the pursuit of STEM, there should be more information provided to students interested in humanitarian STEM efforts by formal and informal educational institutions.

Gratification was the most referenced internal factor among participants. Those who had discussed their enjoyment of STEM, talked about how it played into their intentions to pursue it professionally. Thus, when participants enjoy STEM experiences regardless of their innate proficiency in field, they feel optimistic about pursuing a career in it. Even when participants didn't necessarily have hobbies related to STEM, they found themselves enjoying STEM which contributed to being receptive to pursuing a career in it. It is then important to create educational STEM environments that are able to foster enjoyable learning experiences.

External Factors

External factors were also divided into three categories: finance, environment, and role model. Finance was the least mentioned external factor; however, it was still relevant to mention among participants that did and those who didn't. Students' interests in STEM in some capacity tends to be shaped by their conceptions of potential future occupations and earnings (Lichtenberger and George-

Jackson 2013, 21). Those who talked about financial gain as a factor of pursuing STEM, seem to mention it as a coincidental benefit to their intentions. Very few participants mentioned pay as a significant reason in their pursuit of a STEM career. It is possible that due to the age of the participants, they felt financial gain was not an important aspect at this current time. Additionally, unlike their predecessors, the participants may feel the personal enjoyment of their careers outweighs its financial gain. It is also plausible that participants didn't want to seem shallow in their explanations of their career pursuits or felt there was an unsaid understanding that STEM careers paid well by default.

A participant's environment typically referred to the expectations set by the spaces they identified with or were consistently present in. Due to the study taking place in Silicon Valley among Tech Challenge participations, it would then be typically expected that the students in the study were already inclined to pursue STEM. In some respects, such is true, as students in this felt they were in spaces that had pushed them into wanting to pursue STEM or adjusting their goals in their pursuit of STEM. Culturally relevant STEM spaces can contribute to creating connections with students by relating to their personal experiences, which has been shown to work especially among young women of color (Young, Young, and Ford 2019, 10). More research could be conducted specifically on this factor to account for the various sub-effects and factors of pursuing STEM in one of the most technologically innovative cities internationally. Aside from the themes connected to Silicon Valley, it is very much prevalent that the spaces a student develops play an important role in their career pursuits. Thus, being mindful of how important environments play in the interests of STEM is important to creating spaces for STEM learning.

Role models were the most mentioned factor among both internal and external factors that influenced participants to pursue STEM. A majority of participants discussed having a role model in their life that inspired or supported their interests in pursuing STEM careers. In many cases, participants seem to feel more inclined and interested in the STEM field because someone in their life was in the industry. Participants tended to cite role models as being the representation they needed to feel reflected in the field**.** Allowing students to have role models in their lives is a major driving force in how they percieve themselves as adults and their pursuit of future careers (Hutton 2019, 19). Though even when participants

didn't know a STEM professional personally, they still had role models who fostered their interests in the field. If their role model wasn't in the STEM field, they were playing supportive roles in participant interests in STEM pathways. Role models are then an essential aspect in the development of youth interests and persistence in STEM. Participants then view adults in their lives as symbolic reflections of themselves or pillars supportive of their interests.

Gender Differences

When comparing both internal and external factors between gender groups, no significant differences were found. It is possible that due to the skewed gender ratio of the sample, differences between the groups were unseen. However, minor differences between genders were noted for potential research interests in the future. It was found that young women were more diversified in their career interests but tended to gravitate towards Biology related fields. The young women were more diversified in their career interests potentially due to a lack of visualizing themselves in the field long-term. Women presently are not largely represented in the STEM field which could feed into the mentality that the young women in TTC didn't feel inclined to continue down STEM pathways. Research has found that major barriers pitted against young women in STEM are a lack of engaging computing curriculum, hostile class cultures, a lack of role models, and popular cultural representation (Ashcraft et al. 2017, 233). As such, young women may feel unwelcomed or intimidated in the pursuit of STEM careers. Similar to the altruism factor, it is possible that young women feel more inclined to enter biology because it is associated with the healthcare of others. Young women may associate the health sciences with work related to "helping others and for contributing to society" (VanLeuvan 2010, 260). Additionally, both gender groups in some capacity recognized the unhealthy competitiveness and stressful environment STEM spaces could foster. Such reflects that regardless of gender, there is recognition of the participants that STEM is typically dominated by men. Having the young men be mindful of the exclusionary nature of STEM can help contribute to addressing it. If the representation of gender and sexuality are not discussed within STEM, it would only contribute to the expectation that STEM is solely related to masculine identities (Miller et al. 2020, 349). Though, young women were more likely to mention

negative experiences in STEM spaces related to feeling alienated or recognizing a hostile club environment. As mentioned prior, it is likely due to the hostile environments STEM fields have fostered that have led to the young women having negative experiences compared to their male counterparts. Research has extensively noted that the STEM field has been especially unfriendly to women and people of color (Forbes 2020, 14). Since this study could not effectively detail gender differences in the factors that influenced STEM pathways, more research should be conducted about the subject.

Recommendations

Based on the data gathered from the TTC participants, The Tech may wish to consider allocating their resources to further diversify and expand their current programming. This study showed the importance of role models for encouraging students to pursue STEM career pathways; thus, the Tech may want to consider a solidified mentoring program. Currently, The Tech has held various mentoring workshops and fairs, but has not sustained a consistent mentoring program. Having an established mentoring program at The Tech could be used to foster more role model connections and provide opportunities for young people to see themselves as STEM professionals. It's especially important to build on the current mentoring program to develop connections for youth who may not have role models in their lives to support them.

The Tech may also consider implementing informational fairs that could help participants become more knowledgeable about STEM pathways. Providing participants with more information about potential career interests could contribute to the retention of youth in STEM. Participants in this study often referred only to a set list of STEM career options such as computer science or biology. Providing participants with more information could assist in diversifying their interests allowing for more pivoting within STEM career pathways rather than leaving STEM altogether. Additionally, role models that are not STEM professionals could also utilize the fairs as a way to obtain information about STEM career pathways. Providing fairs that are open to the public can allow participants and their role models alike to learn about STEM pathways and resources on how to pursue them.

Finally, throughout the research process, several participants asked about volunteer opportunities with The Tech and The Tech Challenge. Thus, in response to these questions a program could be created that transitions participants into volunteers with The Tech or another organization for interested participants. Many of the participants seemed eager to continue working in some capacity with The Tech Challenge and saw it as an opportunity to further develop their STEM experience. Allowing participants to continue fostering their interests and experience in the STEM field can contribute to them ultimately pursuing it long-term. In regard to levels of importance, The Tech's continuous development of a mentorship program could greatly benefit participants of TTC interested in pursuing STEM through supportive and constructive relationships.

Conclusion

In collaboration with San José State University (SJSU) and The Tech Interactive (The Tech, this study examined the factors that motivated adolescents to pursue STEM careers within the context of The Tech's The Tech Challenge. Due to their interest in making their programming more inclusive, The Tech sought to conduct a study of their yearly The Tech Challenge to understand participant experiences. The Tech staff and I conducted twenty-four online interviews with fourteen young women and ten young men. Participants were asked about their future plans and motivations for pursuing STEM careers which influenced the creation of categories used to analyze factors. Two categories were derived from participant response: internal (natural propensity, altruism, gratification) and external (finance, environment, role model). Overall, role models were the factor most referred to by participants as being influential to their interests in pursuing STEM. Role models were either supportive of participant interests in STEM or STEM professionals participants knew personally. In relation to motivational factors, we also hoped to analyze differences between gender groups. Though due to the skew of gender representation, no significant differences were found. Recommendations for The Tech are the creation of an established mentorship program, informational STEM career fairs, and a transitional program for alumni of The Tech Challenge to opportunities at The Tech.

CHAPTER THREE

GENDERED EXPERIENCES IN STEM PROGRAMMING

In this chapter I reflect on key findings and limitations of the research collected. I also cover the anthropological impact of my research and potential future research projects The Tech and similar learning center could pursue in the future. Both internal (natural propensity, altruism, gratification) and external factors (finance, environment, role models) influenced TTC participants to pursue STEM careers. Young women and men are both mostly motivated by role models in their life that are working in the STEM industry or support their interests in the field. Young women were more motivated by internal factors in comparison to young men who were more motivated by external factors. As mentioned, prior though we wanted to examine non-binary experiences in addition to young women and men we did not receive any responses from non-binary youth.

Outcomes and Key Project Findings

While crafting the project questions for The Tech based on prior research, I had anticipated major gender differences to exist between the young women and men I was going to interview. However, there were a lot of similarities in the factors that motivated TTC participants to want to pursue STEM pathways. TTC participants regardless of gender identity, were influenced to pursue STEM due to the presence of a role model engaged in STEM or one that supported their interests in the field. Despite not all the young women were interested in STEM as a future career, a majority of them were and those unsure were still considering STEM as a major in college. Additionally, though I had predicted that gender differences existed between TTC participants, I did not expect young women to be more motivated by internal factors in comparison to their male counterparts. Moreover, based on prior research I understood the

domineering gender exclusionary nature of STEM but was taken back at young women talking about those personal experiences.

As The Tech Interactive stands, it is working hard to ensure their spaces are inclusive to the greater San Jose area. With the addition of new space, they're challenging themselves to expand their resources and programming to better serve their community in addition to promoting gender inclusivity. In discussion with my recommendations in Chapter 2, The Tech Interactive could further develop their mentoring program to capitalize on role model relationships and network development among young people. It would also be beneficial to create pathways for TTC participants to volunteer with The Tech or a collaborating learning center that could assist in broadening their experience with STEM. The creation of informational career fairs could also help guide or teach TTC participants interested in STEM. Additionally, role models or caretakers who may not know a lot about STEM could attend these fairs to learn more about and gain insight into the industry.

Anthropological Impact

In line with the objective of the project and The Tech's intentions, by discussing the experiences of TTC participants, I learned about the factors that influenced them to pursue STEM careers and the gender differences between them. Interviewing TTC participants, provided insight into how young people perceive themselves and STEM careers. I learned that TTC participants needed to feel capable of pursuing STEM by feeling represented or supported by important people in their lives. Though I didn't find major differences between gender groups, there were still contrasts present worth noting. Young women in particular feel more inclined to pursue STEM because they view it as a field that could help others. They also were more likely to have negative experiences in STEM environments than their male counterparts. In discussion

with current anthropological theory, it is likely due to the Americanized ideals regarding traditional gender roles that women are seemingly absent in STEM. It is the presence of American models of the sexual division of labor and other historically sexist ideals that can lead to female deficit in STEM (Mukhopadhyay 2004, 483). In terms of future pursuits, young women were spread out in their career interests (aerospace, art, engineering, etc.) in comparison to young men who were more interested in engineering but not biology. Overall, I learned that having personal touchstones in the STEM industry is what can ultimately make a difference in a young person's interests in a STEM career regardless of gender.

As mentioned prior, The Tech Interactive works hard to make their museum spaces inclusive to its community through steering committee meetings and collaborations with organizations like San José State University to conduct research for internal development. During the course of the project, The Tech has only enhanced their interests in conducting research across different scopes of their programming. In collaboration with myself, The Tech has only continued to pay attention to gendered experiences in addition to other proper representation within TTC. Similar intentions have been reflected in their research collaboration with my colleague, Andriana Bodrouk, in her project to identify how The Tech can be a more welcoming environment among various communities in San Jose. As they continue to expand and create new programming, I am certain The Tech will continue to expand their insight of the different experiences that engage with their educational spaces.

Limitations of Research

One of major limitations of the project was the lack of time for interview question development and revision. Due to the project timeline, I had to create questions and get them revised twice in order to assure that we could reach out to participants at the best time. If we had

reached out any later than we had, it could've potentially made outreach more difficult for the TTC team. Even after conducting the interviews, I felt the questions could have been more cohesive and focused on the project objectives if more revisions were made by myself with assistance from The Tech. Another limitation was though we wanted to look at nonbinary experiences, no nonbinary youth applied to take part in the study. This may be due to a lack of effective messaging on my part to make my study more inclusive to identities outside the tractional gender dichotomy. As there does exist a history of researchers abusing minoritized groups for data collection, there may have also been a fear to participate in the study based on their personal identity that has been historically disenfranchised. Additionally, though we wanted to have an equal representative sample of 12 young women and 12 young men our data was skewed to 14 to 10. This may be due to when project outreach began participants had finished TTC in April and thus had lost interest in anything related to it several months afterward. Moreover, at the same time we were reaching out to participants they were on their summer vacations or beginning to be prepared for a new year of school. In some cases, due to the ages or families of the participants, they were starting at entirely new schools, which may have deterred them from participating in the study. Furthermore, Jhaid Parreno pointed out that most of the participants came from affluent schools which skewed the data to represent a niche and stereotyped version of TTC participants. The lack of representation of Title 1 schools may be due to the economic inequalities that limit the accessibility of TTC participants from those schools.

The Future of Gender Inclusivity Research at The Tech

Though my gender inclusivity research with The Tech may have ended, there still exists the need to examine gendered experiences in informal educational settings. There is potential in examining nonbinary and other minoritized identity experiences within TTC to further develop

inclusive gender programming. Since there was an emphasis on the importance of role models among TTC participants, it would be beneficial to closely examine the practice of mentorship programs in addition to conducting more research among caretakers. Another lens of looking at TTC experiences, is noting the different ethnic groups participating in the program and conducting a representative analysis of which communities are underrepresented. Additionally, though the current study did not examine economic inequalities there were concerns about the lack of representation of Title 1 schools amongst the participants interviewed. Research in the future that examines the representation and participation of Title 1 schools in TTC would be another valuable source of examining inclusivity.

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Appendix A

Interview Protocol

(20-30 mins per interview) *follow up questions if participants seem direct

Thank you for participating! We really appreciate you taking the time to speak with us.

*Are you okay with me recording this interview? This will only be for my references and certain staff at The Tech?

1. Introduction
    1. Name, Gender, Age, Grade, School
2. What are your hobbies/things you do in your free time?
    1. How did you start participating in this?
    2. Why did you start participating in this?
3. Do you participate in any STEM-related hobbies/activities? (summer camps, clubs, helping a relative fix a car, coding in your free time, etc.)
        1. What are they?
        2. How did you start participating in this?
        3. Why did you start participating in this?
            1. What do you like about this hobby/ies?
            2. What do you dislike about this hobby/ies?
4. How have you been exposed to STEM in a school setting? (classes, science fair, etc.)
    1. What STEM activities have you done at school?
        1. Were these part of your classes or activity outside of class?
            1. What did you like about this?
            2. What did you dislike about this?
    2. How have these experiences shaped how you feel about STEM?
5. Is this your first year participating in The Tech Challenge?
    1. If not, how many years have you been participating?
6. Can you tell me about your team?
    1. Who was on your team?

    2. How did you form your team?
7. Who was your advisor?
    1. How did they become involved?
    2. Was there anything about them you identified/connected with?
8. How did you hear about The Tech Challenge?
9. What motivated you to participate in The Tech Challenge?
10. How was your overall experience participating in The Tech Challenge?
        1. Were there any things you particularly liked?
        2. Were there any things you particularly disliked?
11. What are you planning to do moving forward? (after graduating?)
    1. What inspired/influenced you to do that?
    2. How has TTC played a role?
12. Do you have any questions for me? (About the project, etc.)

How did you hear about the study? If you have any teammates that have not applied to take our survey, please let them know we are till taking participants? We'd love to hear more about your experiences!