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Through the Lens of Latinas: The Influences of an Out-of-School Time STEM Program

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THROUGH THE LENS OF LATINAS: THE INFLUENCES OF AN OUT-OF-SCHOOL TIME STEM PROGRAM

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DEDICATION

This dissertation is dedicated to my supportive family and friends, my professors and mentors, and all readers who wish to learn STEM education in the United States and explore the influences of a STEM educational program from the lens of Latinas.

THROUGH THE LENS OF LATINAS: THE INFLUENCES OF AN OUT-OF-SCHOOL TIME STEM PROGRAM

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University of the Incarnate Word, 2020

Science, Technology, Engineering, and Mathematics (STEM) have been the foundation for discovery and technological innovation in the United States. The United States considers STEM education as a national priority to compete in the global economy and protect the nation's innovation ecosystem. The high demand for careers in STEM fields promotes the importance of STEM education. However, Latinos, as the fastest-growing ethnic group in the United States, face many challenges in STEM education relating to a lack of progress, degree attainment, and participation in STEM professions.

This research aimed to explore the learning experience in an out-of-school (OST) STEM program, called Girls in STEM, and how it influenced Latinas' self-efficacy, interest, and career development. The research focused on a single-case study of a STEM OST program in South Texas and utilized eight embedded cases to explore three research questions. The sample for this study consisted of 41 middle school and high school girls (grades 7 to 12) who had long-term participation experiences in the STEM program. The data for this qualitative study consisted of in-depth interviews, presentations from art-based activities, and visual arts. Followed by the case study design, the researcher purposefully sought in-depth information from embedded "unit of analysis," which represented eight participants in the study (Yin, 2013, p. 23). Each case presented different aspects to answer research questions. The researcher analyzed interviews and

art-based activities from participants through the lens of social cognitive theory and social cognitive career theory (Bandura, 2001; Lent, Brown, & Hackett, 1994).

The findings explored Latinas' learning experiences in an OST STEM program. Participants expressed the program created a beneficial learning environment for them, where they engaged in various activities and interacted with adults in the program. The learning experience, as the starting point of SCCT model, had influences on the development of self-efficacy and the formation of interests. In this study, the integration of different subjects, opportunities for collaborative work and conversational interactions with professionals, are three characteristics of cultivating Latinas' interest in STEM. Additionally, many girls in this study noticed the stereotypes of women in STEM, and gender bias exists in many STEM fields. Socioeconomic status may limit Latina's options and affected their career development.

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Chapter 1: The Influences of an OST STEM Program

Science, Technology, Engineering, and Mathematics (STEM) have been the foundation for discovery and technological innovation in the United States. The United States considers the STEM education as a national priority to compete in the global economy and protect the nation's innovation ecosystem (Taningco, Mathew, & Pachon, 2008). According to the labor statistics, employment in STEM occupations grew much faster than the employment growth in non-STEM occupations over the past decade. Among all STEM-related occupations, many are professional jobs in the fields of computer science and mathematics, engineering, and technology (Christensen, Knezek, Tyler-Wood, & Gibson, 2014). From 2014 to 2024, the data showed that computer occupations, engineers, and mathematical science occupations are growing the fastest with the highest job gains among all types of STEM occupations (Fayer, Lacey, & Watson, 2017). The high demand for careers in STEM fields promotes the importance of STEM education.

However, based on the current pipeline and STEM participation rates, the numbers of U.S.-trained professionals in STEM fields is inadequate to meet the nation's needs (Taningco et al., 2008). There are discrepancies between the demographics of the U.S. population and the demographics of students currently entering these STEM careers (Jones et al., 2018). Retention data indicate that only 40% of students entering college as STEM majors complete degrees in STEM, which causes the labor shortages in the United States (Young & Young, 2018). The United States must increase the numbers of graduation and workforce in the STEM fields to maintain its global economic leadership

Additionally, the diversity in race/ethnicity of the population is not reflected in the population of STEM professionals (Flores, 2011). As the fastest-growing racial group in the

United States, Latinos faced many challenges, which resulted in the relative lack of progress and poorly represented in STEM fields in terms of degree attainment and participation in STEM professions. Compared to other racial and ethnic groups, Latinos achieved lower academic achievement and degree of attainment, gained less educational opportunities, and had fewer participators in STEM professions (Taningco et al., 2008). The study showed few Latinos enter the educational pathway that leads to a STEM degree, and among those who do, many fail to complete the process. When compared with non-white races/ethnicities, Latinos also suffer from a worse gender gap in STEM careers (more men than women) compared with Asians and African Americans. Taken together, it is important for researchers and educators to take serious actions to increase achievements for Latinos. Cultivating STEM talent in a diverse population of STEM learners is necessary to redress current labor trends, which also relates to STEM as a whole (Wade-Shepherd, 2016).

This research was to explore the learning experience in an Out-of-School Time (OST) STEM program, called Girls in STEM, and the influences on Latinas' self-efficacy, interest, and career development. This study has implications for many categories of educational stakeholders, including students, program developers, teachers, program evaluators, policymakers, and researchers in related fields. Understanding Latinas' experience and hearing from their voice are critical to support the development of STEM educational and underrepresented students' career pathways. Chapter One begins with an overview of the research background, followed by the research interests, research significance, and research questions. This chapter also covers the overview of the research design, site, participants, and dissertation.

Context of the Study

In line with the rapidly changing technological era, the United States places much effort into refining and promoting STEM education. From the U.S. government, along with Congress, State legislatures, and school STEM programs, extensive efforts were implemented to reform K–12 STEM education and cultivate the next generation of skilled scientists, engineers, technicians, and science and mathematics educators (Kennedy & Odell, 2014). In the document of "STEM for All," the administration attempts to expand STEM education and employment opportunities to all students, primarily focusing on women and minorities who are underrepresented in many STEM fields (Handelsman & Smith, 2016). Starting in the fall of 2014, House Bill 5 was implemented in Texas to provide students with earlier exposure to a coherent course sequence (Yoon & Strobel, 2017). High school students were required to choose an endorsement among five categories, including (1) STEM, (2) business and industry, (3) public service, (4) arts and humanities, and (5) multidisciplinary studies. House Bill 5 stipulates that public schools need to concentrate on college preparation and career readiness by expanding student curriculum options, reducing the stress from standardized testing, and increasing school accountability (Texas Education Agency, 2014). These policies provided the structure and guidance that schools needed to provide a pathway which aimed at preparing students for a college and career choice. The STEM endorsement and STEM-related courses in other endorsements affected students' exposure to and achievement of STEM-related courses, which ultimately have an impact on students' STEM college and career entrance (Sigala, 2016).

The increasing interest in STEM education and participation has led to the creation and growth of numerous OST programs designed to increase the number of young students seeking a college degree and eventually enter into STEM-related careers (Saw, Swagerty, Brewington,

Chang, & Culbertson, 2019). Many public and private organizations offered OST STEM outreach programs after school and during the summer, designed to supplement STEM education, and maintain or stimulate an interest in STEM careers among students at different levels (e.g., elementary, secondary, and post-secondary). In contrast to traditional approaches, which stress the learning of facts, concepts, and theories, these OST STEM programs have typically included STEM-focused learning activities such as mentoring, math/science enrichment curriculum, STEM career seminars, and field trips to STEM professional settings (Saw et al., 2019). Additionally, many OST STEM programs are focused on underrepresented populations, including females, underrepresented racial minorities, students of color, and those of low socioeconomic status. These OST learning experiences are beneficial for students to connect meanings with scientific experiments and concepts for which there is not enough time during the school year (Phelan, Harding, & Harper-Leatherman, 2017). Students who struggle in the classroom had their first moment of success in STEM subjects in an OST activity (Lauer et al., 2006).

Many types of research demonstrated the positive effects of participating in OST STEM programs on middle school students' interest in STEM fields (Mohr-Schroeder et al., 2014; Saw et al., 2019; Young & Young, 2018) and self-efficacy in academic (Mann, Smith, & Kristjansson, 2015), technology and computational thinking (Leonard et al., 2016), and other STEM activities (Yanowitz, 2016). Besides that, research also showed the OST STEM programs are beneficial to increase students' school connectedness (Mann et al., 2015), builds STEM identity (Young & Young, 2018), and has an impact on STEM persistence (Taylor, 2019). In recent years, robotics and game design have been identified as new technologies and innovative pathways in STEM programs (Hinton, 2017; Leonard et al., 2016). Many researchers

demonstrated that such modern technologies (e.g., robotics and game design) offer a project-based learning environment, help students to translate abstract mathematics and science concepts into concrete real-life applications, and connect areas that typically seem disconnected (Grubbs, 2013; Hinton, 2017; Nugent, Barker, Grandgenett, & Adamchuk, 2010). When looking into the results of girl-focused programs, research demonstrated the positive outcomes in girls' self-efficacy in STEM, interests in STEM-related subjects, and excitement of STEM-related careers (Heaverlo, Cooper, & Lannan, 2013; Levine, Serio, Radaram, Chaudhuri, & Talbert, 2015). For instance, the study of Ogle, Hyllegard, Rambo-Hernandez, and Park (2017) recruited middle school girls from underserved districts and integrated fashion to ignite curiosity about STEM fields. The results of Ogle et al.'s study revealed positive influences on girls' self-efficacy in math and science, while the learning may foster future educational interest and achievement in the STEM fields.

Despite many positive findings, prior research was limited in terms of methodological issues to study OST STEM programs. Most study samples used only single-item survey measures to assess the importance of STEM summer programs on student outcomes, which have a low level of measurement reliability and validity (Saw et al., 2019). Most research brought in qualitative findings only during the final discussion section, which undervalued the functions of qualitative studies in improving the quality and the application of studies (Jimenez et al., 2018). Thus, this study utilized qualitative case study design to learn about eight Latinas' experience of participating in an OST STEM program.

Despite the recent increase in studying racial and ethnic minorities, the research gap is lacking in understanding Latinas in STEM. As mentioned by Villa, Wandermurem, Hampton, and Esquinca (2016), the low representation of women, and Latinas specifically, has been the

topic of inquiry by various organizations and institutions that have aggressively reached out to females without significant impact. In the literature, studies investigating women and minorities in STEM focus on equity of access and are looking at the data in broad terms (Peralta, Caspary, & Boothe, 2013), rather than Latinas specifically in engineering and computer science (Villa et al., 2016). Many researchers looked into Latino high school students' academic achievement (Sharkness, Eagan, Hurtado, Figueroa, & Chang, 2010) and major selections (Bottia, Stearns, Mickelson, Moller, & Parker, 2015; Zimmerman, Johnson, Wambsgans, & Fuentes, 2011) to exam the factors affecting the persistence of Latinos in STEM. However, there is less knowledge about Latina's culture, socioeconomic status, and possible barriers in STEM fields education and career majors (Lopez, 2018). In response to these gaps, this study chose a special STEM program in South Texas and explored its influences on Latinas' self-efficacy, interest, and early-stage career development by utilizing qualitative in-depth interviews and art-based activities.

Research Interests

My personal and work experiences are related to the research design and process. These personal experiences affected my interests in the research topic and helped me better understand the research contexts. Whereas, my work experience helped me define the research scope and provided prior experiences with the case. The following section presents my research interests from three aspects.

As a middle school student. When I was little, my parents discovered my interest in music and painting. They encouraged me to learn music and art with after-school classes during elementary and middle school years. Even though I experienced boredom and frustration, the long-term learning experiences in the after-school classes developed my personality, built up my art skills, helped me acquire more friends. In middle school and high school, I got many chances

to perform music at various events. The good performance increased my self-efficacy, which helped me overcome challenges, achieve better academic grades, and motivated me to achieve higher education. Looking back on my personal experience, environmental, personal, and behavioral factors all operated as interlocking mechanisms and influenced one another bidirectionally (Bandura, 2001; Lent, Brown, & Hackett, 1994). I developed my interests through a long-term off-campus learning experience. Over time, these interests transformed into higher confidence in school learning, higher levels of expectations, and resulted in more positive learning outcomes. My experience of participating in after-school programs awoke my interest in studying the influences of an OST STEM program on middle school and high school girls.

As a graduate student. I worked for Girls in STEM program, as a research assistant since 2017. It was my assumption that the participants in the program might experience some similar things as I did in the after-school classes. I conducted mixed-method studies (Wang & Frye, 2019) to explore the influences of participating in the summer camp on middle school girls' attitudes toward STEM fields. Both quantitative survey and qualitative interviews showed there was an increase in attitudes, especially for math attitudes (Wang & Frye, 2019). The data also indicated that the camp had influenced campers' future study and career choices. These findings raised my interest in further study in some broader concepts. I have a strong personal interest in exploring how long-term participation in an OST STEM program influenced participants' self-efficacy, interests, and career development.

As a researcher. In my first PhD qualitative research class, my professor asked all students to answer the question: "how have you experienced the process of integration into the PhD program?" To accomplish the task, we used various methods, such as narratives, photovoice, focus groups, and drawing, to gather data and generate different perspectives. One of

my classmates expanded on my idea of using a drawing to show her experience. I liked how she used different colors to present different stages in her PhD study. For example, black presented the beginning of her PhD that she did not know anything. She used the white part, to indicate the end is coming soon, but it could also be a new cycle of black. At that time, I was impressed by the power of art-based activities and had an idea to integrate arts into my dissertation. Thus, in this study, I combined art-based activities with interviews, which helped me explore ideas and triangulate results. The visual arts and related findings are mainly presented in Chapter Four. This research, is not only a reflection on my understanding of the research scope but also represents my philosophy of doing research.

Why This Study Now?

Current STEM OST programs differ in length, residency, target population, and research focus (Kager, 2015). Many such OST programs focus on traditional STEM fields, such as computer science, engineering, math, and earth and space science (Ogle et al., 2017). However, few researchers are looking at the influence of the participation in a STEM program on young Latinas' self-efficacy, interests, and early-stage in career development through cooperating with robotic and programming (Glessner, 2016; Taningco et al., 2008). There is not enough research on young Latinas' engagement with OST STEM programs. Therefore, this study aims to contribute to the gap in the body of knowledge about the effects of long-term STEM OST program participation on middle school girls', especially or Latinas' STEM attitudes, interests, and STEM-related career development.

Furthermore, there is a need to draw from the research to consider implications for developing an OST STEM program, designing STEM activities in OST settings, and exploring Latinas' self-efficacy, interests, and career pathways. The STEM program in this study plans to

expand to the elementary (4th to 5th) and high school levels. Drawing insight from participants' long-term experiences, the researcher and program directors in this case will gain knowledge about the influence of this program on participants' interests, self-efficacy, and early career development. These findings may provide applications and suggestions for future researchers, educators, program directors when developing STEM programs, designing activities, and connecting with students' self-efficacy and interests.

Moreover, Girls in STEM program has a uniqueness and particularity. Although there are some STEM programs in South Texas (e.g., iD tech, Interactive Technology Experience Center, SASTEMIC), not all of them are free nor specially designed for middle school girls (iD Tech, 2018; Saygin, Yuen, Shipley, Wan, & Akopian, 2012). Through this unique study, researchers, educators, people who are interested in these topics may gain useful information about the influences of this special case on Latino participants' self-efficacy, interests, and career development.

Research Questions

This research explored the following questions:

Q1: What are middle school and high school Latinas' experiences of participating in an OST STEM program?

Q2: How does the learning experiences of participating in an OST STEM program impact Latinas' self-efficacy and interest, especially in STEM fields?

Q3: To what extent do the learning experiences of participating in an OST STEM program influence Latinas' career self-efficacy and career interest, especially toward STEM fields?

Overview of the Methodology

Following Stake (1995) and Yin (2003), I used a single-case embedded design to explore the influences of an OST STEAM program, called Girls in STEM, on Latinas' self-efficacy, interest, and career development. This study selected Girls in STEM program as the single case, and used eight embedded cases to answer each research question.

Research site. Girls in STEM program was launched in South Texas in 2015, with the mission of inspiring and empowering girls, to be innovative and passionate about their future in the fields of STEM (Wang & Frye, 2019). In 2015, the program enrolled 25 middle school girls from four Title I middle schools. By the summer of 2019, the program served girls in grades 6 to 12, through four different programs: one middle school level STEAM summer camp (called miniGirls), one robotic clubs (called miniGirls club), and two high school level STEAM camps (called megaGirls and megaResearch). The camp focused on targeting underrepresented populations from Title I public schools in South Texas and providing robotics and STEAM learning experiences to middle and high schoolers. The schools in the Girls in STEM program have high numbers or high percentages of students from low-income families and need financial assistance from local education agencies (U.S. Department of Education, 2018).

Participants. Participants in this study were girls with long-term participation experiences in the Girls in STEM program. The researcher had conducted interviews or art-based activities with 41 middle school and high school girls (grade 7 to 12) who had been participating in Girls in STEM program for more than two summers or two academic years. Eight out of 41 girls were selected as embedded cases. These eight participants were all Hispanic and in grades seven to eleven. Based on the research questions, I selected the appropriate unit of analysis which would "best help understand the case" (Stake, 1995). I used the theoretical framework to

examine the scope of study and to identify the relevant information about each participant. My knowledge and experience working as a research assistant within the program helped me design the questions, build relationships with participants, engage in data collection, and analyze the embedded cases.

Theoretical Framework

The theoretical framework introduced and described the theories that substantiated the research questions, combining the theoretical framework with social cognitive theory (SCT) and social career cognitive theory (SSCT). This study combined theoretical framework with SCT and SSCT. This SCT framework provided triangular relationship between the behavioral, personal, and environmental factors with an emphasis on understanding middle school and high school Latinas' self-efficacy and interests. Whereas, the SCCT framework included a model of career choice variables, such as self-efficacy, outcome expectations, interests, and goals, which illustrated participants' career goals and career development. The combination of SCT and SCCT helped explain the behavior-personal-environment factors and program influences on participants' self-efficacy, interests, and career developments.

Significance of the Study

This study examines a special case and explores the influences of participation in a STEM enrichment program on Latinas' self-efficacy, interest, and early-stage career development, especially its emphasis on the Latino population in South Texas. The study used art-based activities and interviews to draw insights from middle school and high school girls' experiences, and understand the influences of the case on students' learning as well as the self-efficacy changes throughout the learning process. The findings of this study provided applications for educators, researchers, teachers, program managers for future STEM program

development. The results of the study would add to the current body of research on Latino middle school girls' attitudes, interests, self-efficacy, and career development, especially towards STEM fields.

Overview of Dissertation

This research is an embedded case study to explore the middle school and high school girls' learning experience of participating in a STEAM program and the influences of the program on their interests, self-efficacy, and career development. In this study, I engaged in a single-case study of Girls in STEM program in South Texas and used the eight embedded cases to explore the research questions.

Chapter Two is a discussion of the theoretical framework for this research and a review of related literature. I introduce the topic of STEM Academy and OST programs in the United States, in combination with an overview of STEM education from international perspectives. Then, I discuss the integration of Science, Technology, Engineering, Arts, and Mathematics (STEAM) in the second part. In the last part, I review the issues and barriers of gender, ethnicity, and cultures in STEM education.

Chapter Three is an overview of the methodology for this study in detail, presenting the research design, describing the site and participants, and defines the purposeful selection; followed by the data collection methods used, with the data analysis process, along with an explanation of the trustworthiness and researcher positionality. Chapter Four mainly presents eight middle school high school girls' backgrounds, their experiences of participating in a Girls in STEM program, and how the program affected their self-efficacy, vocational interests, and career choices. Chapter Five answers the three research questions based on the findings from eight embedded cases. It also discusses the culture, family, and socioeconomic influences on

Latina's development. The researcher also gives suggestions and provides implications for future studies.

Chapter 2: Theoretical Framework and a Review of the Literature

This chapter presents the theoretical framework and reviews related literature to explore the influences of participating in Girls in STEM program on Latinas' interest, self-efficacy, and career development. The theoretical framework introduces theories and describes the key factors that substantiated the research questions. The literature review presented related studies in the research scope.

In this study, the theoretical framework was combined with SCT and SSCT. The SCT framework provided a triangular relationship between the behavior, personal, and environmental factors, which helped understand the formation of self-efficacy and interests. While, the SCCT framework included a model of career choice variables by introducing self-efficacy, outcome expectations, interests, and goals. These key factors helped explore the middle school and high school girls' career development. The combination of these two theories explored the influences of behavior-personal-environment factors and learning experience in an OST STEM program on middle school and high school girls' self-efficacy, interests, and career developments.

The literature review was organized into four sections: an overview and introduction of STEM education in the United States and other countries, with a special emphasis on Texas STEM academy and OST programs, the integration of STEAM, the integration of programming, art, and revealed the challenges of integrating different subjects into STEM and finally the issues and barriers of gender, ethnicity, and cultures in STEM education with an emphasis on the challenges of Hispanic and Latino in STEM fields.

Theoretical Framework

This research is not simply intended to study *what* are participants' learning experiences, but also answer *how* and *to what extent* the students' self-efficacy and career development have

been influenced by the STEM enrichment program. As shown in Figure 1, the theoretical framework of this study is mainly driven from Bandura's (1986) SCT and Lent et al. (1994)'s SCCT. In this section, I illustrate the behavioral-personal-environmental relationship by introducing SCT and SCCT. The information about SCT and SCCT are provided, including the relationship between SCT and SCCT and Triadic Reciprocality. What follows are the key concepts in this theoretical framework, including self-efficacy, outcome expectations, interests, and goals.

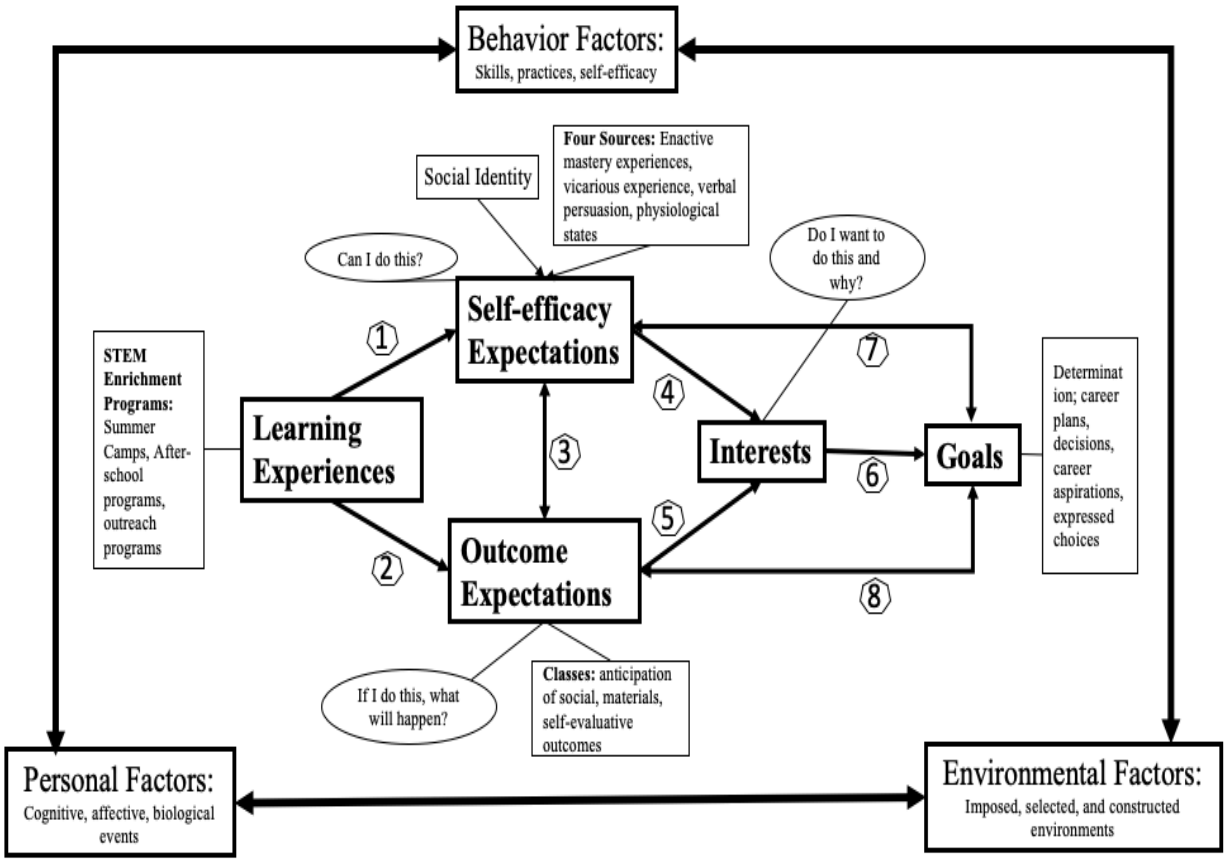

Figure 1. Overall theoretical framework.

Overview of social cognitive theory. SCT draws from both behaviorism and cognitive theories and highlights the idea that much human learning occurs in a social environment (Merriam & Bierema, 2013). SCT explains psychosocial functioning in terms of the causation

between behavior, personal factors, and environmental events (Bandura, 1986). SCT highlights a variety of cognitive, vicarious, self-regulatory, and self-reflective processes, which are assumed to play an important role in guiding psychosocial functioning (Lent et al., 1994). By applying SCT in this study, I explored the functions of behavior, personal, and environmental factors on middle school and high school girls, and investigated how learning could develop the behavior, personal, and environmental competencies.

Bandura (1986) advocated a model of interaction termed "triadic reciprocity," which refers to human behavior as an interactive agency which influences internal personal factors, behavioral patterns, and environmental events (Bandura, 1989, 2001). As shown in Figure 2, the model of reciprocal causality illustrates that, (a) personal attributes are in the form of cognitive, affective, and biological events; (b) external environmental factors include imposed, selected and constructed environments; and (c) the behavioral factors consist behavioral capability of the individuals, which is dependent upon the correct knowledge and skills needed to carry out the desired activities (Bandura, 2001; Rengert, 2011). These three attributions all operate as interlocking mechanisms and influence one another bidirectionally (Bandura, 2001; Lent et al., 1994). Each of these factors provide areas of focus for interventions that can create significant human behavior changes (Rengert, 2011).

As shown in Figure 2, Bandura (1986) believes learning is a triangular relationship between the behavior, the personal, and the environmental factors. In SCT, learning is a complex process, involving a combination of motivation, beliefs, self-efficacy, the use of particular learning strategies, and support from the social environment (Nugent et al., 2010). Modeling and practice under simulated conditions are widely used with positive results to develop intellectual, social, and behavioral competencies (Bandura, 1986). In the learning process, observing others is

useful for people to gain knowledge, rules, skills, attitudes, and beliefs (Merriam & Bierema, 2013). By observing models and the consequences of those models' behaviors, people cognitively process information, learn the usefulness and appropriateness of the behaviors, and act following their beliefs concerning the expected outcomes of actions (Bandura, 1986).

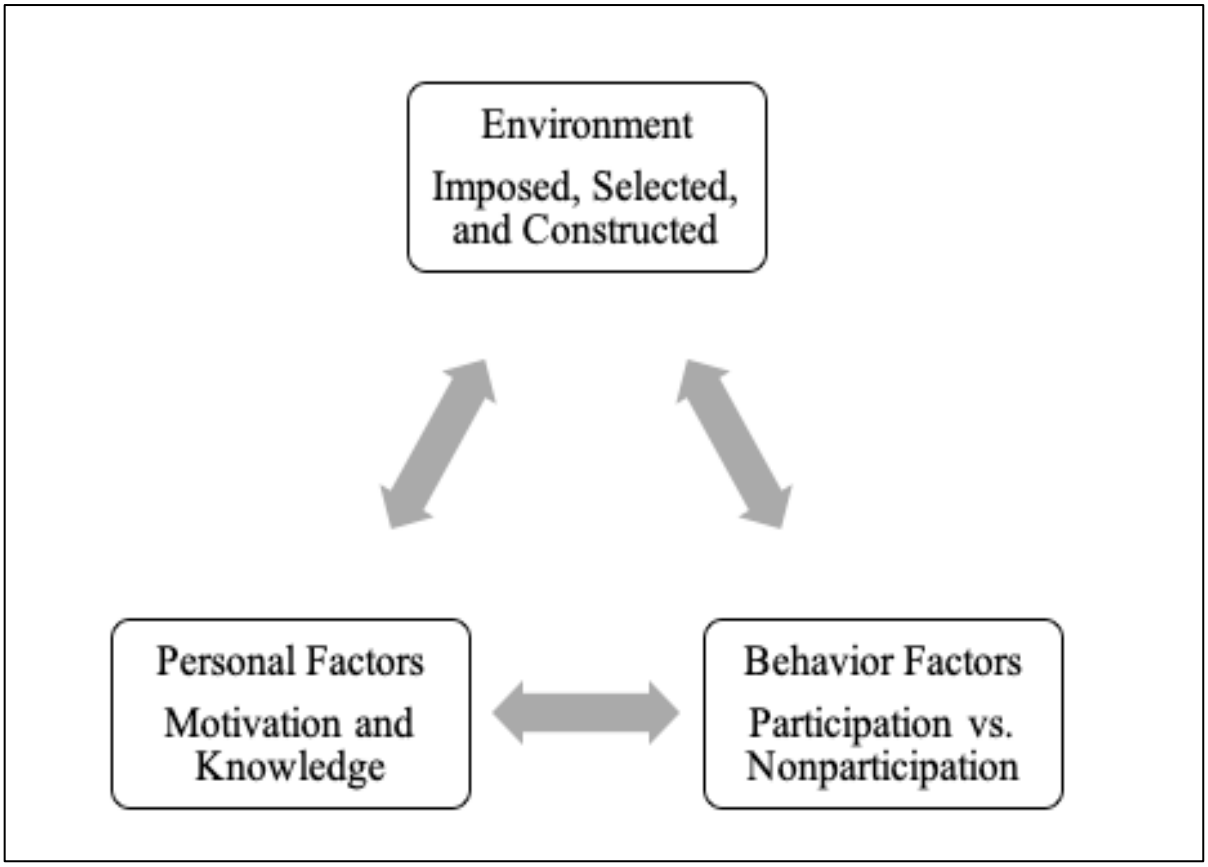

Figure 2. Key concepts in social cognitive theory.

Overview of social cognitive career theory. Lent et al. (1994) adapted, elaborated, and extended Bandura's (1986) SCT to the domain of academic, career behavior, and career development processes. Similar to other career models (Osipow, 1990), Lent et al. (1994) believed the joint impacts of persons and environments on career outcomes and explored socio-cognitive mechanisms based on SCT. Lent et al. (1994) attempts to build a stronger link between Bandura's (1986) theory and its life-career translation during childhood and adolescence.

SCCT aims to explain the development of career and academic interests, the formation of career choices, and the achievement of performance outcomes. SCCT highlights the issues of career entry and the early life periods (e.g., late adolescence and early adulthood), expresses the important influences of academic development on career development, and emphasizes the interplay between self-referent thought and social processes in guiding human behavior. During adolescence, people often expose to various potential career-related activities from their environments and perform various occupational tasks through observing and modeling others.

Unlike SCT, SCCT emphasizes the differential causal weight of certain factors on career development. SCCT discusses how the combination of self-efficacy, outcome expectations, and goals interrelate with personal factors (e.g., gender), and environments (e.g., support, barriers) within the career development model. By contrast to SCT, SCCT tends to focus on personal and self attributes rather than dynamic interactions between individuals and changing situations. Furthermore, instead of highlighting a variety of cognitive, vicarious, self-regulatory processes in SCT, SCCT emphasizes three social-cognitive mechanisms, which are "self-efficacy beliefs, outcome expectations, and goal representations" (Lent et al., 1994, p. 83). In addition, SCCT gives the directional causal paths to deal with career behaviors, which differ from Bandura's model of triadic reciprocality. In this study, SCCT helped to elaborate on the career-related personality variables and explored the learning mechanisms that could contribute to the analysis of middle school and high school girls' life-career pathways.

Theoretical Framework: The Relationships Between SCT and SCCT

Figure 3 presents the relationship between SCT and SCCT in this study. The first framework is based on SCT. Environmental, personal, and behavioral factors all operate as interlocking mechanisms and influence on one another bidirectionally (Bandura, 2001; Lent et

al., 1994). Specifically, each of these three factors in SCT provides its own area of focus for interventions which can able to create significant human behavior changes (Rengert, 2011). Through these repeated activities, observations, feedback, and modeling, people practice their skills, develop performance standards, form self-efficacy in tasks, and gain certain outcome expectations of their performances (Lent et al., 1994).

Meanwhile, the inner framework is based on Lent et al. (1994)'s model of career interest development model. This model highlights cognitive and behavioral influences during childhood and adolescence. As shown in Figure 3, this model started with the learning experience people gained during childhood and adolescence. People's environment exposes them to a wide range of possible career-relevant behaviors. Children and adolescents also directly or indirectly exposed with diverse activities from others which helped them reinforce the ideas of pursuing certain activities. Through repeated activities engagement, modeling, and feedback from others, children and adolescents developed a sense of likes, dislikes, and indifferences regarding career-relevant activities and occupations. Taken together the path one and path two, children and adolescents refined their capabilities, developed personal standards, formed a sense of efficacy, and gain certain expectations about the outcomes of their performances. The emergence (Path 3) of self-efficacy expectations (Path 4) and outcome expectations (Path 5) lead to the formation of interests. As mentioned by Lent et al. (1994), it is difficult for robust interests if there is a lack of self-efficacy or anticipated outcomes. In the process of growing interests, people also develop their intentions or goals for further activity exposure (Path 6). It is important to note that, people's self-efficacy, self-evaluative outcomes (Bandura, 1986), outcome expectations may affect activity goals directly as well as indirectly through interests (path seven and path eight).

Self-efficacy and outcome expectations played the roles in helping people to interpret, organize, and apply their skills.

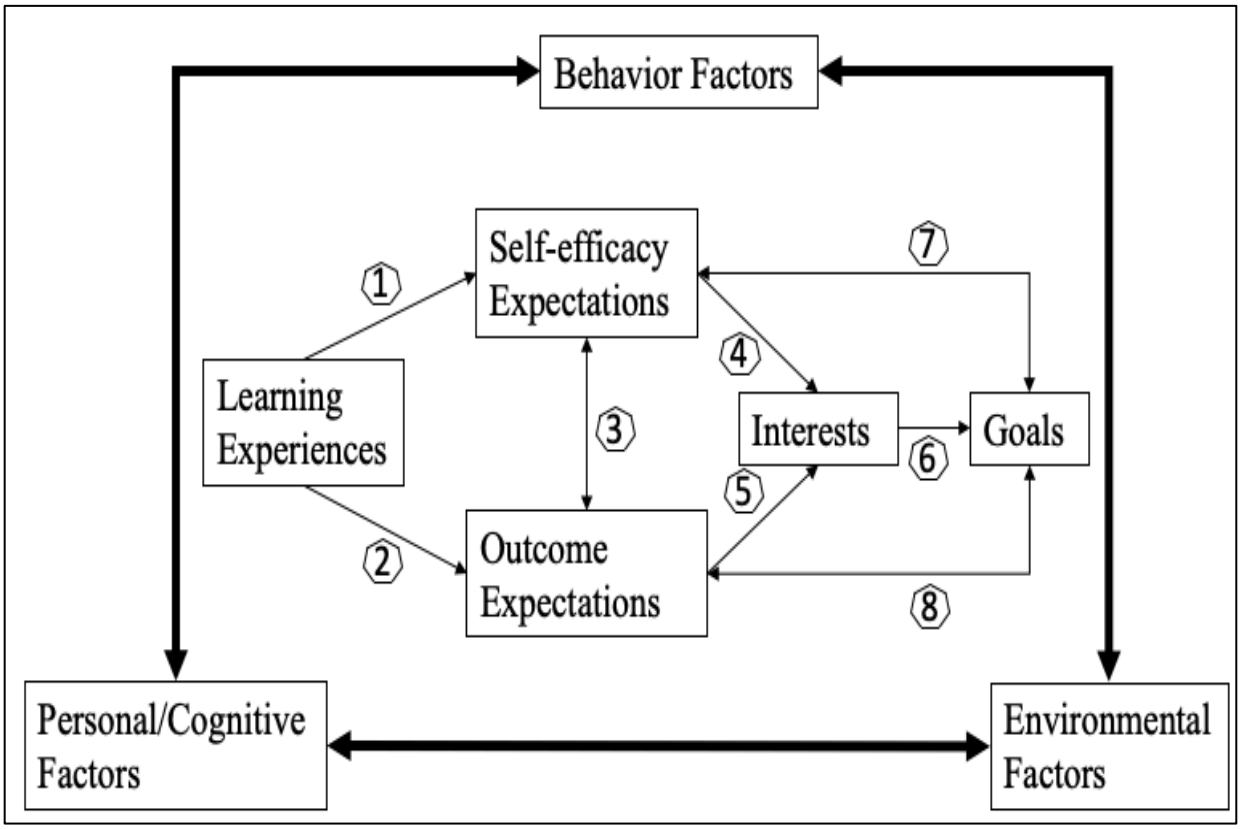

Figure 3. Relationships between SCT and SCCT.

Key Concepts in Theoretical Framework

The following part discusses each factor from the perspectives of SCT and SCCT, including self-efficacy, outcome expectations, vocational interest, and goals. These key concepts have been used in the data analysis as the theoretical propositions as well as the circumstances in the case study. Table 1 presents the key concepts of each factor.

Table 1

Key Concepts in SCT and SCCT

Factors	Definitions	Reflecting questions
Self-efficacy Expectations	Self-efficacy is the belief in one's ability to influence events that effect one's life and control over the way these events are experienced. (Bandura, 1994).	Can I do this?
Outcome expectations	Personal beliefs about the consequences or outcomes of performing particular behaviors (Lent, Brown, & Hackett, 2002, p. 262).	If I do this, what will happen?
Vocational Interests	Patterns of likes, dislikes, and indifferences regarding career-relevant activities and occupations" (Lent et al., 1994, p. 88).	Do I want to do this and why?
Goals	A goal is the determination to involve in a certain action or to affect a particular future outcome. Goals includes as "career plans, decisions, career aspirations, and expressed choices" (Lent et al., 1994, p. 85).	Career plans, decisions, aspirations, choices

Key factor one: self-efficacy. The belief of personal efficacy is the foundation of human agency (Bandura, 2001). This belief system is important in SCT, because it "affects action not only directly, but through its impact on other classes of determinants as well" (Bandura, 2001, p. 28). Perceived self-efficacy influences people's goal aspirations, impacts the choice of which challenges to undertake, how much effort to invest in the pursuits, and how long to persevere in the face of difficulties (Bandura, 1999). For example, challenging goals raise motivation and performance attainments. Furthermore, perceived self-efficacy influences human decision making and causal attributions. People who regard themselves as highly efficacious ascribe their failures to insufficient effort, inadequate strategies or unfavorable circumstances, all of which are correctable. Those of low efficacy attribute their failures to low ability, which is demotivating.

Similar to SCT, self-efficacy in SCCT is seen as the central and the most influential mechanism of personal agency (Bandura, 1989; Lent et al., 1994). Self-efficacy is not a passive cognitive trait, instead, it involves a lot of individual's self-beliefs that "are specific to particular performance domains and that interact in a complex way with other people, behavior, and environmental factors" (Lent et al., 2002, p. 262). Furthermore, self-efficacy helps to determine an individual's choices, effort expenditure, persistence, thought patterns, and emotional reactions when confronted by obstacles. It has a directional causal relationship with academic performance and career-related choices (Lent et al., 1994).

Perceived self-efficacy is constructed from four sources: "enactive mastery experiences, vicarious experience, verbal persuasion, and physiological states" (Bandura, 1977, p. 195). According to Bandura (1997), enactive mastery experiences are seen as indicators of capability; vicarious experiences alter efficacy beliefs through transmission of competencies and comparison with the attainments of others; verbal persuasion impact one's certain capabilities through social influences; physiological and affective states come from the judgment of individual's capableness, strength and vulnerability of dysfunction. Any given influence on an individual, depending on its form, may operate through one or more among these four sources (Bandura, 1997). As the most influential source of efficacy information, enactive mastery experiences "provide the most authentic evidence of whether one can master whatever it takes to succeed" (Bandura, 1997, p. 80). Successes raise the efficacy, whereas failures lower it, especially if failures occur before a sense of efficacy is firmly established (Bandura, 1997; Lent et al., 2002). However, not all of the performance attainments impact on efficacy beliefs. Bandura further explains it that "the same level of performance success may raise, leave

unaffected, or lower perceived self-efficacy depending on how various personal and situational contributors are interpreted and weighted" (p. 81).

Vicarious experiences and verbal persuasion both largely fall into the environmental factors centering on the social environment and social support (Rengert, 2011). Vicarious experiences emphasize the power of modeling which is "an effective way to raise efficacy" (Bandura, 1997, p. 86). People appraise their abilities through social comparisons. Verbal persuasion is a further means of increasing one's efficacy through bolstering self-change and appraisals.

Physiological and affective states are "to enhance physical status, reduce stress levels and negative emotional proclivities, and correct misinterpretations of bodily states" (Bandura, 1997, p. 106). Specifically, the physiological factors play a significant role in health functioning and in an activity requiring physical strength and stamina, because they influence people's autonomic arousal, mood states, and affective states.

Application of self-efficacy in STEM education. As one of the most important parts of people's belief system, students' self-efficacy beliefs are the foundation for entrance and persistence in the STEM profession (Brown, Concannon, Marx, Donaldson, & Black, 2016). Students' self-efficacy, expectations, and aspirations are influenced by the behaviors and beliefs of family, friends, and teachers (Lent et al., 2002). Students will be more likely to pursue a career or an educational path toward a career, if they have a high self-efficacy (Ernst, Belrose, Eckhardt, Hild, & Rodriguez, 2014). Bandura (1991) points out that intrinsic interest is better predicted by perceived self-efficacy rather than actual ability. This finding explains why many girls lose interest in STEM, even though they do not lack STEM abilities. Girls lack the belief that they are capable of attaining STEM goals, which leads to decreased interest in pursuing

STEM subjects and lower perceived self-efficacy in STEM careers (Bandura, 1999; Rittmayer & Beier, 2008).

The gap between female and male students' self-efficacy in math and science begins in the middle school ages (Brown et al., 2016). Prior researches have shown there were no differences between boys' and girls' self-efficacy beliefs (Britner & Pajares, 2006; Fouad & Smith, 1996; Pajares, Britner, & Valiante, 2000). But, boys and girls differ in their outcome expectations and sources of self-efficacy (Britner & Pajares, 2006; Fouad & Smith, 1996). In practice, the study of Brown et al. (2016) indicates students' perceptions of STEM and self-efficacy are the best predictors for students' intentions to persist in STEM. When it came to the sources of self-efficacy, mastery experience was a better predictor for girls than boys (Britner & Pajares, 2006). These findings explain why many girls lose interest in STEM even though they do not lack STEM abilities. When girls lack the belief that they are capable of attaining STEM goals, it leads to decreased interest in pursuing STEM subjects and lower perceived self-efficacy in STEM careers (Bandura, 1999; Rittmayer & Beier, 2008). Thus, developing students' positive self-efficacy belief is a significant factor in facilitating students' success in STEM (Brown et al., 2016). It is especially important for girls to believe they are able to be successes in STEM fields (Kager, 2015).

Key factor two: outcome expectations. Based on Lent et al. (2002), outcome expectations are "personal beliefs about the consequences or outcomes of performing particular behaviors" (p. 262). Instead of reflecting on self-efficacy question (Can I do this?), outcome expectations ask question about "If I do this, what will happen?" and imagine the results of performing given behaviors. Lent et al. (1994) follows Bandura's (1986) model and divides outcome expectations into several classes, such as the anticipation of social (e.g., benefits to

one's family), materials (e.g., financial gain), and self-evaluative (e.g., self-approval) outcomes. Both outcome expectations and self-efficacy influence human behaviors, but the outcomes depend on the nature of a particular activity, as initial expectations and self-efficacy differ in causal influences on human behaviors. Under the influences of academic and career environments, consideration of response outcomes, and personal capabilities, career-related outcome expectations may become an independent contribution to motivation and behavior. People are more likely to gain highly valued positive outcomes and to avoid behaviors that may result in particularly adverse consequences (Ambriz, 2016). For example, if a person anticipates negative outcomes of science-intensive career fields, he or she may avoid choosing careers in these fields even though he or she has high self-efficacy for science (Lent et al., 1994).

Key factor three: vocational interest. Lent et al. (1994) extended of Holland's (1997) theory of interest (Renninger & Hidi, 2011). Lent et al. (1994) defined vocational interests as "patterns of likes, dislikes, and indifferences regarding career-relevant activities and occupations" (p. 88). The vocational interests reflect on question "Do I want to do this and why?" (Wigfield & Eccles, 2010). In keeping with Bandura' triadic reciprocality, major components in SCCT are seen as influencing one another bidirectionally over time (Lent et al., 1994). In the view of SCCT, self-efficacy is seen as a predictor of interests (Nugent et al., 2010); in bidirectional relationship, interests promote opportunities for self-efficacy development (Lent et al., 2002) and effects knowledge, career orientation, and performance through career outcome expectancy and self-efficacy (Lent et al., 1994; Nugent et al., 2010). Students are more likely to pursue careers in areas of interest and to achieve in subjects of interest (Nugent et al., 2010). Nugent et al. (2010) indicates that subject matter interest is positively related to school achievement, course enrollment decisions, and science degree attainment.

Key factor four: goals. Personal goals play a central role in career choices and decision-making theories (Lent & Brown, 1996). It also affects people's self-efficacy and outcome expectations. People organize, guide, and sustain their own efforts to achieve goals over a long period of time even without external reinforcement. For example, people who hold positive beliefs about their science competences and positive outcomes of science-related career pursuit are more likely to pursue education in science field and cultivate personal goals in science-related careers.

Lent et al. (1994) explained two types of goals. First, a goal is the determination to partake in a certain action or to affect a particular future outcome. In this case, goals are driven by people's capabilities to impact desired future outcomes and respond their own behavior based on internal standards for performance. When people fulfill the goals, people achieve a sense of self-satisfaction and meet their internally-set standards. Other definitions of goals include "career plans, decisions, career aspirations, and expressed choices" (p. 85). In these contexts, goals are driven from people's presumed role in motivating behavior. The differences among these various goal terms impact people's commitment to specific intentions and efforts.

Summary

The theoretical framework of this study combines with SCT and SCCT. The combination of self-efficacy, outcome expectations, and personal goals is seen as the basic of career development and represents key factors by which people are able to exercise personal behaviors (Lent et al., 2002). Self-efficacy occupies a central role, because it not only affects adaptation and change on participants' behaviors, but also the impact on other determinants, such as outcome expectations, interests, and goals. The applications of these two main theories helped understand the learning experiences gained from participating in the STEM program and explore

the influences of the STEM program on self-efficacy, vocational interests, and career development.

Review of the Literature

STEM play important roles in the United States educational reforms and global economy (Bishop, 2015). The United States considers STEM education a national priority to strengthen the political, social, and economic positions (Christensen et al., 2014). However, research from specific school and learning settings, makes it clear that STEM education is facing many challenges and issues. Underrepresented minorities need more resources and attention. The following review of the literatures gives context to STEM education in the United States and from international perspectives. The barriers to and trends supporting integrating different subjects in STEM are discussed. The last part discusses the issue of gender and ethnicity in STEM education

Introduction and overview of STEM education. This part mainly focuses on presenting STEM education in the United States which helps demonstrate the research background of this study. It begins with the overview of STEM education, then introduces Texas STEM Academy and OST STEM program in the U.S, and concludes by discussing and comparing STEM education in Germany, Japan, and China.

Overview of STEM education in the United States. STEM education is a pivotal issue in current educational development and reform. In line with the rapidly changing technological era, the United States places much effort into refining and promoting STEM education. From the U.S. government, along with Congress, State legislatures and school STEM programs, extensive efforts were implemented to reform K–12 STEM education and cultivate the next generation of skilled scientists, engineers, technicians, and science and mathematics educators (Kennedy &

Odell, 2014). All efforts make it clear that it is more important for youth to prepare to bring knowledge and skills to solve problems, make sense of information in future careers, and know how to apply in real-life situations.

Emerging technologies have brought about new career expectations and trajectories, especially in STEM fields (Roehrig, Moore, Wang, & Park, 2012). According to the U.S. Bureau of Labor Statistics (2019), there were nearly 9.7 million STEM jobs in 2018, representing 6.0 percent of U.S. employment. Estimates suggest that by 2028, there will be nearly 10.56 million STEM jobs, which account for 6.3 percent of U.S. employment. Employment in STEM occupations should grow by 8.8 percent, or 858,500 jobs, between 2018 to 2028, compared with 5.0 percent net growth in non-STEM occupations. From 2014 to 2024, computer occupations, engineers, and mathematical science occupations are predicted to grow fastest with the highest job gains among the types of STEM occupations (U.S. Bureau of Labor Statistics, 2019). This high demand for careers in STEM fields confirms the importance of STEM education.

Over the past decade, employment in STEM occupations grew much faster than the employment growth in non-STEM occupations. Most of the STEM occupations are professional jobs in the fields of computer science and mathematics, engineering, and technical support that require the skills in science, technologies, engineering, and mathematics (Christensen et al., 2014). Other than professional jobs, there is an increasing number of jobs at all levels of the workforce require knowledge of STEM (National Research Council of the National Academies, 2011). The early recognition of STEM talent is necessary to cultivate cross-disciplinary mathematics and science competence through advanced coursework. Increasing interest, access, participation, and achievement in STEM can help the United States to meet the demands of the labor force (Young & Young, 2018).

Although several reports demonstrated positive effects of K-12 STEM education on continuing scientific leadership and economic growth in the United States, these reports indicated many students have not attainted enough skills for the demands of today's economy and the economy of the future (National Science Board, 2018). K-12 STEM education still has many challenges and required increased efforts to strengthen students' abilities in math, reading, and science. For example, the 2018 Programme for International Student Assessment, recorded the reading, mathematics, and science scores of about 600,000 students from 79 nations. The newest results showed U.S. students scored slightly better in three subjects. Reading and science were slightly above the average, but math still falling below the average (Schleicher, 2019). In the past years, the United States ranking in math was 35th in 2015 which fell from 28th in 2012, while Science and Reading ranked 25th and 24th respectively in 2015 among 71 educational systems (Program for International Student Assessment, 2018).

Furthermore, in STEM fields, there is an increasing percentage of foreign-born individuals who became the most educated scientists in the United States (National Science Board, 2018). Especially, in the fields of engineering and computer science, about 6 out of 10 are foreign-born workers. National Science Board demonstrated that US-born employees are lacking the required mathematics, computer, and problem-solving skills to succeed in STEM careers, and international students fill an increasing portion of elite STEM positions in the United States. For example, in 2015, more than 50 percent of foreign-born individuals in the United States with a Science and Engineering degree were from Asia. While, Europe claims 13 percent of S&E degree holders in the United States, India, and China are the leading countries providing a higher proportion of S&E degree holders and doctoral graduates (National Science Board, 2018). These

challenges and issues highlighted the importance and issues of STEM education in the United States.

Introduction of Texas STEM (T-STEM) academy. Researchers demonstrated education in formal schools has some challenges that may cause the disengagement of students in STEM study. On the one hand, the funding issues and increased prevalence of standardized testing may cause a lack of hands-on laboratory in the curricula of formal middle school (Levine et al., 2015). In a school classroom, students are often the passive learners, where they learn on their own rather than learning through conversations among peers (Kager, 2015). Most of the time, students are given made-up problems and forced to solve the problems, instead of learning through practicing real-world knowledge. On the other hand, middle school education highly emphasizes mathematics and science (e.g., geoscience, physics, chemistry, biology) which lack of integration and connection with other subjects (Atkinson & Mayo, 2010; Forbes, 2017; Sanders, 2009). Engineering and technology education does not get enough attention in elementary school and middle school in the United States.

To better implement STEM education in formal schools, STEM education programs have been widely implemented in-school curricula across the United States following the America Competes Act of 2007 (Kuenzi, 2008). In 2016, Texas launched the T-STEM initiative, the biggest investment in inclusive STEM high schools in the nation and opens its first seven T-STEM academies. After that, the number of T-STEM academies has increased exponentially. In the 2018-2019 school year, Texas launched 94 state designated T-STEM Academies and has nine planned campuses for the 2018-2019 school year (Texas Education Agency, 2019). T-STEM focuses on improving instruction and academic performance in STEM-related subjects and aims to increase the number of students who study and enter STEM careers (Heinrich,

2018). According to Texas Education Agency (2019), T-STEM will stimulate student interest in STEM through:

> (1) providing dual credit at no cost to students, (2) offering rigorous instruction and accelerated courses, (3) providing academic and social support services to help students succeed, (4) increasing college readiness, 5) reducing barriers to college access, 6) aligning to regional workforce needs for ICIA, P-TECH, and T-STEM models.

Once designated as a T-STEM academy, the school receives rigorous academic curriculum, professional development, and other STEM education resources through one of seven T-STEM centers that partner with universities, local education agencies, business, and non-profit organizations (Saw et al., 2019). Researchers demonstrated that students who attended inclusive STEM high schools benefited from the STEM-specialized curriculum and academic supports, but their testing scores and outcomes may not have differences than at non-STEM schools (Saw et al., 2019). No reference entry T-STEM academy students performed better in mathematics and science than non- T-STEM academy students from matched comparison schools. However, the study of Sahin, Oren, Willson, Hubert, and Capraro (2015) demonstrated there was no significant growth in science, mathematics, and reading between T-STEM academies and non-TSTEM schools between the years 2008 and 2011. The authors indicated that T-STEM might need more time to fully implement the curriculum given by the state, to reap what they sow academically. Similarly, Saw et al.' s (2019) study demonstrated inclusive STEM high schools had no impact on student test scores in mathematics and science, the effects were positive when completing advanced level math courses in high school.

Introduction of OST program in the United States. Enrichment through OST STEM programs becomes another option to cultivate students' interests and increase their achievements in STEM fields. Most STEM enrichment programs, such as afterschool programs, summer camps, competitions, offered OST activities and incorporated emotional, aesthetic, and social

elements into learning activities. According to Young and Young (2018), the characteristics of OST programs include 1) providing content knowledge and instructions for special groups, 2) helping to create connections between STEM knowledge to real-world applications. 3) promoting informal STEM learning and providing informal learning opportunities.

The influences of OST STEM enrichment programs is well researched. Research demonstrated that STEM enrichment programs increase students' interest in STEM content and careers (Mohr-Schroeder et al., 2014), STEM self-efficacy (Leonard et al., 2016; Mann et al., 2015), school connectedness, self-identity, and excitement about STEM subjects (Leonard et al., 2016; Mann et al., 2015; Mohr-Schroeder et al., 2014; Yanowitz, 2016). For example, in Scherrer's (2013) study, the one-time outreach program with an emphasis on engineering improved participants' perceptions of engineering and raised students' awareness of being an engineer. In another example, the study of Kwon (2017) demonstrated hands-on experiences are important to encourage interest and enthusiasm toward learning. By using technologies, students had more chances to explore mathematical concepts with real-world solutions.

Many OST programs have a special focus on middle school years, because the middle school period is important when it comes to attitudes toward STEM fields (Dare, 2015). It is also an essential formative and transactional period for students to prepare for a fast-changing future and learn foundation skills for future successful STEM careers (Christensen et al., 2014). Hence, many researchers believe middle school years are an appropriate time to intervene and encourage students to pursue advanced studies and careers in related fields (Hill, Corbett, & St Rose, 2010; O'Brien et al., 2017; Moreno et al., 2016).

Furthermore, many OST programs have special emphasis on middle school girls. Compared to boys, middle-school-aged girls present lower positive attitudes and interests

towards STEM fields (Dare, 2015). This is especially true for girls' where attitudes towards science become negative between seventh and ninth grades, and it will decline steeper for girls than boys (O'Brien et al., 2017). Girls begin to lose interest in both science and physical activity during the middle school years (Hill et al., 2010). This gender gap in girls' attitudes and interests, may affect girl's performance in STEM study and their lifestyle choices associated with important life phases (Hill et al., 2010).

Many educators are putting effort into to keeping middle school girls' interested in STEM subjects, which may motivate girls to pursue careers in STEM fields later. One way is to improve the feeling of fitting and belonging in science. Researches demonstrate a sense of fit is an important factor in female intentions to continue in the mathematics fields and achieve success in STEM fields (Clapham, Ciccomascolo, & Clapham, 2015; O'Brien et al., 2017). Students can increase interest in pursuing STEM careers by developing positive or enthusiastic feelings of fitting and belonging in science. Furthermore, having female role models is another way to keep middle school girls interested in STEM fields. By providing tangible information, female role models represent women succeeding in science (Levine et al., 2015).

When it comes to STEM enrichment program design, Holba (2015) mentions that STEM programs should focus on "mentoring, collaboration, topics of social relevance, and incorporation of verbal and language skills" (p. 27). By providing opportunities for cooperative learning, girls can use the verbal and social skills necessary to maximize the benefits of STEM programs. The results of many OST female-oriented programs demonstrated an increase in girls' confidence, interest in STEM subjects, and excitement of STEM-related careers (Heaverlo et al., 2013; Levine et al., 2015). For instance, the study of Ogle et al. (2017) recruited middle school girls from underserved districts and integrated fashion to ignite curiosity about STEM fields. The

results of Ogle et al.'s study revealed positive influences on girls' self-efficacy in math and science, while the learning may foster future educational interest and achievement in the STEM fields.

International perspectives in STEM education: from Germany, Japan, and China.

STEM education originated in the United States in the 1990s. Since the United States promoted STEM to a national strategic position. STEM education has received high attention from many countries. As the initiator of STEM education, the United States has undoubtedly become a model for other countries' STEM education development. Followed by the United States, Japan, China, and Germany promoted STEM education as a new direction in the 21st-century education reform and are attempting to localize STEM education by aligning it with their educational systems (Yang, 2015).

Germany highlighted its vocational education system and promoted the concepts of lifelong education in STEM education (Yang, 2015). German educational system has a tradition of focusing on vocational education, which has the mission of ensuring the quantity and quality of the workforce. Compared with STEM education in the United States, MINT education in Germany pays more attention to the development of students' career interests. Meanwhile, Germany combines MINT education with lifelong education, and with the goal of promoting the development of the MINT education chain. Germany reinforces the MINT education by giving positive incentives to children in the early stages of career development.

Japan has strong math and science abilities; in 2015, the Program for International Student Assessment showed Japan ranked 2 in science literacy, 5 in mathematics literacy, and 8 in reading literacy (Program for International Student Assessment, 2018). Japan is leading in the total number of scientific researchers, the number of patents, and the number of publications in

the world. According to the Statistics from OECD, Japan has more than 650,000 researchers, which ranked behind the United States and China (Schleicher, 2019). Moreover, since 1980s, the Japanese government emphasized cultivating students' basic scientific research abilities. Thus, in Japan, STEM education in primary and secondary schools has focused on the cultivation of research-oriented talents, increased students' interest in STEM-related subjects, and strengthened STEM elite education in senior high schools.

The STEM path of Japan is inspiring to China. In recent years, the Chinese government introduced and implemented a number of policies to deepen STEM education and encourage innovation, including giving autonomy to schools, restructuring school curricula, and cultivating students' 21st-century abilities. The policies advocate the integration and innovation of the curriculum and emphasize the cultivation of students' innovative and practical abilities. According to White Paper STEM Education 2029 (National Institute of Education Science, 2017), STEM education in primary and secondary schools should pay more attention to develop students' STEM interests and improve students' capacity for scientific and technological innovation, employment and entrepreneurship.

Advancing K-12 STEM Education and What are Challenges

In this part, I present the implementation and integration of different subjects in advancing K-12 STEM education. Integrative methodologies and project-based learning (PBL) are commonly used approaches when advancing K-12 STEM education. I review the literatures about the integration of programming, robotics, and art into STEM education. The challenges of integrating STEM education also is addressed.

Integrative methodologies and PBL as teaching approaches. STEM learning experiences prepare students to compete in worldwide economy and provide valuable experience

for students to get prepared for advanced learning and employment. In recent years, the use of the term STEM has become the buzzword among numerous U.S. stakeholders who have paid attention to the call to improve secondary school instruction and promote careers in STEM fields (Breiner, Harkness, Johnson, & Koehler, 2012). When it comes to the question of "What does STEM look like?", STEM can be a variety of activities which bring more inquiry and project-based approaches than traditional teaching approaches (Breiner et al., 2012). From an educator perceptive, when integrating science, technology, engineering, and mathematics together, the concepts of STEM become more solid.

Integrative methodologies of four fields (science, technology, engineering, and mathematics) improve students' interests and learning in the education of science, technology, engineering, and mathematics (Becker & Park, 2011). According to Becker and Park, many educators integrate the four STEM subjects through different forms of design-based learning and education professions. Research showed the integration effects have a positive impact on understanding content, improving constructivist learning, motivating students' to learn, and bringing abstract knowledge to concrete concepts (Becker & Park, 2011; Fortus et al., 2005; Riskowski, 2009).

Using project-based learning (PBL), as one of the teaching approaches, creates more opportunities for students to interact with the content in a context that allows them to make meaning of their learning (Venegas, 2018). As described by Venegas, the essential elements of PBL design include, "(1) content knowledge and application of 21st century skills, (2) challenging open-ended project or question, (3) inquiry, (4) authenticity, (5) student-centered, (6) reflective, (7) revision and (8) final presentation" (p. 20). PBL has a close association with STEM fields. In STEM education, it is essential for students to connect the "school" knowledge

to the real world and understand the importance of the content to their lives, which in turn may raise their attitudes towards STEM subjects (Wang & Frye, 2019).

Using programming and robotics in STEM education. Computer programming is increasing popularity in STEM education. Integrated programming in technology education is also changing the STEM education landscape and disciplines (English, 2017). The concept of computation thinking has been widely applied by STEM educators, researches, and stakeholders to improve students' interests, problem-solving skills, and technology knowledge (Gadanidis, Borba, Hughes, & Lacerda, 2016). The application of computation thinking can improve mathematics education as well (English, 2017).

Robotics and game design have been identified as new technologies and innovative pathways in STEM programs in recent years (Hinton, 2017; Leonard et al., 2016). Many researches demonstrated such modern technologies (e.g. robotics and game design) offer a project-based learning environment, help students to translate abstract mathematics and science concepts into concrete real-life applications, and connect areas that typically seem disconnected (Grubbs, 2013; Hinton, 2017; Nugent et al., 2010). For instance, the study of Hinton (2017) revealed robotics activities led to an increased interest and higher self-efficacy in STEM tasks. Hence, there is a need to incorporate more modern technologies and learning tools to engage students in science learning.

From STEM to STEAM: integrating art into STEM. STEAM has been viewed as other approaches to increase students' interests and improve study access to STEM in many nations (English, 2017). The addition of the arts in STEAM education provides more learning opportunities and real-world contexts which meet more students' interests. The research demonstrated that integrating arts with STEM education has positive relationships with students'

academics (English, 2017; Forbes, 2017). Forbes (2017) mentions students involved in performing arts are less likely engaging in risky behavior, while more likely to enjoy school and maintain higher GPAs. What's more, the involvement with music in courses specifically increase students' academic achievements and standardized tests during the middle school and high school years (Yoon & Strobel, 2017). As Yoon states, students ages eleven to fifteen present higher self-consciousness, which results in losing some intuitive and emotional characteristics. During these ages, activities that stimulate right-brain function, such as listening to music, help students' brain development and body integration. By the end of high school, music and other rhythmic activities have had a maximum effect on teenagers' brains development. The creative and critical thinking skills students developed in arts, foster the four skills which link to STEM success (Forbes, 2017), including "observation, visual thinking, recognizing and forming patterns, and manipulative ability" (p. 17). Similarly, Hadzigeorgiou, Fokialis, and Kabouropoulou (2012) state scientist and artists have different creativity categories, but fall into the same imaginative process. Integrating arts in science courses helps students to see things in novel and unusual ways (Hadzigeorgiou et al., 2012).

Researchers and educational programs practiced the concept of STEAM in various approaches and many real life cases across the United States (Forbes, 2017). Stemtosteam.org did STEAM programs in other states, with companies and institutions, such as Sesame Street, Reading is Fundamental, Boeing, Kohler Co., Intel, Apple Inc., and Crayola. Additionally, the concepts of STEAM education were used by preservice mathematics teachers to teach mathematics lessons (Forbes, 2017). This art-based model hosted by Columbus Museum of Art, integrated the learning-thinking model of "observe, describe, interpret, and prove" (ODIP) into mathematics courses (Conley, Trinkley, & Douglass, 2014). The results of this model

demonstrated students' ability to problem-solve, increased students' ability to identify multiple processes to solve mathematical problems, and supported abstract mathematical thinking.

Challenges of integrating STEM education. Research demonstrated that STEM education is facing the problem of the unbalanced disciplines, especially engineering education in elementary and middle school levels haves not got enough attention in many nations (English, 2017). In recent years, although a lot of effort has been put into improving engineering education in the United States, it still has been severely neglected in elementary school and middle school levels. STEM education frequently refers to "science" learning. The disciplines of STEM education highly emphasize science education and raises the level of science education in the elementary, middle and secondary school curricula (English, 2017).

Another challenge of integrating multiple STEM disciplines, is the lack of hands-on experience in formal school learning. In a traditional learning environment, students are often passive learners, that earn on their own, rather than learning through conversation with their peers (Kager, 2015). Instead of learning through "real-world experiences, students are given some made-up problems and forced to solve the problems. As Levine et al. (2015) suggests, more enrichment programs should practice various creative methods to increase the time devoted to hands-on learning, field trips and science experiments, and integrating science, technology, engineering, and mathematics.

Although STEAM education increases students' engagement and learning outcomes, there is less research on STEAM education than STEM education. STEAM education has many challenges: integrating other principles, implementing lessons, and meeting the curricula goals (English, 2017). Integrating arts in STEM education needs to encourage teachers to communicate, collaborate, and co-teach the arts with STEM subjects (Forbes, 2017).

Issues of Gender and Ethnicity in STEM Education

Here I discuss the issues of gender and ethnicity in STEM education; specifically, the situation and challenges of women and Latinos in STEM; as well as review the available literature about OST STEM programs for students of color.

Women in STEM. The gender gap in STEM fields has existed for many decades. Historically, due to gender bias and sexism prevalent within STEM culture, women have had unequal opportunities to pursue an education in STEM fields (Hughes, Nzekwe, & Molyneaux, 2013). Careers in science, math, and engineering are often viewed as masculine careers and not fitting within people's perceptions of feminine work (Kager, 2015; Michael & Alsup, 2016). Historical and stereotypical views about careers, prevents female participation in STEM, shapes girls' attitudes, and undermines women's performance in STEM fields (Clapham et al., 2015; Kager, 2015). Even though the number of women in science and engineering is growing, men continue to outnumber women, especially at the upper levels of these professions (Michael & Alsup, 2016). The gender differences in college degrees will likely continue to expand and gradually shift (Perry, 2019). By graduation, women earn only 29.1% of mathematics and computer science bachelor's degrees, 24.7% of Doctorate degrees in mathematics and computer science, and hold 27% of professional mathematics and computer science positions (Corbett, Hill, & St Rose, 2008).

When it comes to career interest, females are less interested in STEM subjects and careers overall than males, especially in engineering and technology (Michael & Alsup, 2016). While, males present more interest and confidence in scientific abilities and the ultimate decision to pursue scientific careers (Dare, 2015; Levine et al., 2015; Sadler, Sonnert, Hazari, & Tai, 2012). Studies have demonstrated that women perceive more career barriers than men (Gnilka &

Novakovic, 2017). The gender differences in the perception of career barriers can affect women's career aspirations, career interests, and have a more direct effect on career choices and actions.

The gender gap persists for female's career choices in many STEM fields, such as engineering, manufacturing, construction technology, aviation technology, and automotive technology (Hagedorn & Purnamasari, 2012). Female are more interested in careers where they can help others and in which they can make the world better (Clapham et al., 2015; Sadler et al., 2012). Therefore, women are better represented in life science, chemistry, and mathematics within STEM fields (Michael & Alsup, 2016). Engineering and Computer Science are two fields where women were scientifically underrepresented in 2017 and historically (Perry, 2019). In order to retain and recruit more females in STEM fields, it is important to create an environment that will lead to their overall perceptions and increase their interests in STEM learning.

Latinos and Hispanic students in STEM. Latinos are the largest ethnic or racial minority group in the United States (U.S. Census Bureau, 2017). By the year 2050, there will be more than 20 million Latinos between the ages of 5 and 17 living in the United States. Among them, the number of college-age Latinos will increase from 3 million to more than 8 million by 2040 (Cole & Espinoza, 2008). However, researchers indicated Latinos face the greatest difficulties of getting in and out of science and engineering academic programs. In terms of gender, Latinas are underrepresented in STEM fields, holding fewer STEM jobs and receiving fewer STEM bachelor degrees than Latinos.

As the fastest-growing racial group in the United States, Hispanics face a relative lack of progress in STEM education. Similar to other racial groups, the Hispanic group encompasses individuals from a wide range of cultures and ethnic origins, including Mexico, Puerto Rico,

Cuba, Central America, South America, the Dominican Republic, and Spain (U.S. Census Bureau, 2004). Hispanic students from different origins suffer from major racial disparities at different levels of STEM education. For example, the data indicated Puerto Ricans Hispanic groups made greater gains than their African American peers, while Mexican and other Hispanic students demonstrated the smallest gains. Thus, it is important for researchers and educators to take serious actions to increase achievements for Hispanic students.

There are many challenges for Latinos/Hispanics compared to other racial and ethnic groups, including lower academic achievement rates and degree of attainment, less educational opportunity, and less participation in STEM professions (Taningco et al., 2008). First of all, although the dropout rate is continuously decreasing, Hispanic youth still has a higher dropout rate than White and African American youth each year from 2000 to 2016 (National Center for Education Statistics, 2018). Secondly, researchers demonstrated that schools with high African American and Latino enrollments offer less access to high-level mathematics and science courses than schools with low African American and Latino enrollment (National Science Board, 2018). Thirdly, similar discrepancies continue into the career choices, Latinos suffer from a worse gender gap in STEM careers (more men than women) compared with Asians and African Americans (Taningco et al., 2008). As Modi, Schoenberg, and Salmond (2012) stated, the ethnic identities and socioeconomic status are factors that affect Latino girls' STEM interest, perceived ability in STEM fields, and motivation in choosing a career path. For example, under the influences of Hispanic culture, young women are more likely to attend a school close to home because of cultural reasons, as parents want their daughters to live at home (Dowd, Malcom, & Bensimon, 2009).

Finally, for both Latinos and Hispanics students, their selection and persistence in STEM fields, has a significant relationship with their academic preparation in high school, and interest in science and mathematics, and engineering (SME) majors, and a high grade point average (GPA) in high school (Cole & Espinoza, 2008). In the high school phase, both Latinos and Hispanics presented lower GAP and lower interests in SME majors than White students. Once in college, supportive educational environments and the power of role models (e.g., parents, peer and faculty) play an important role in making it to graduation. This is especially true for racial/ethnic minority students, when they emphasized the connection among peers and mentors. However, considering many Latino students' parents only have a high school education, their cultural capital is different from other students and racial groups with college-educated parents. As a result, students with non-college educated parents and from low socioeconomic backgrounds are less likely to have a better understanding of the college academic culture and are more likely to experience negative perceptions (e.g., isolation, cultural alienation) of the university environment.

Although students of color are facing many challenges in STEM education, their growing retention and persistence in STEM is important to United States' economic competitiveness and educational equity. Increasing the number of underrepresented students of color improves the level of creativity, innovation and quality of STEM education (Burke, Mattis, & Elgar, 2007; Michael & Alsup, 2016). Broadening the participation of underrepresented student populations is a major concern for STEM as a whole (Wade-Shepherd, 2016).

Conclusion

Like many other countries, the United States,, puts a lot of effort into improving STEM education and making it a national priority, to strengthen the nation's position globally in

discovery and innovation(Christensen et al., 2014). The U.S. government, along with Congress, State legislatures, and school STEM programs, put extensive efforts into reforming K–12 STEM education to cultivate the next generation of skilled scientists, engineers, technicians, and science and mathematics educators (Kennedy & Odell, 2014). Although many countries, such as China, Germany and Japan, have a lot in common in their promotion of STEM education. They have significant differences in designing the pathways, highlighting the needs, and preparing students for careers in STEM fields.

STEM education in the United States. Research from specific schools and learning settings makes it clear that STEM education is facing many challenges and issues. These issues, as discussed above, included the lack of professional people in STEM fields, formal schools cannot provide enough resources and meet students' needs, the challenges of integrating different subjects, and imbalance of gender and ethnicity in STEM education. In order to promote STEM education and close gaps, many out-of-school programs have been widely implemented by STEM educators, researches, universities, and stakeholders, to improve students' interests, problem-solving skills, and technology knowledge (Gadanidis et al., 2016). This implementation of various OST programs gives opportunities to raise STEM education, as well as providing more resources for underrepresented students (English, 2017).

In order to close the gender gap, middle school years are considered an important period of improving girls' overall persistence, increasing a sense of fit in science, and convincing girls to pursue advanced studies and careers in related fields (Hill et al., 2010; O'Brien et al., 2017; Moreno et al., 2016). Many researchers are seeking ways to retain middle school girls' interest and improve their self-efficacy in STEM fields through designing and implementing various STEM interventions. These STEM programs demonstrated the increase in science confidence,

interests in STEM subjects, and STEM-related careers (Levine et al., 2015; Heaverlo et al., 2013).

As for broadening the level of STEM participation, there are many challenges for Latinos and Hispanics compared to other racial and ethnic groups, including lower academic achievement rates and degree of attainment, less educational opportunity, and less participation in STEM professions (Taningco et al., 2008). Their selection and persistence in STEM fields are influenced by their academic preparation in high school, an interest in SME majors, and a high GPA in high school (Cole & Espinoza, 2008). Cultural capital also influenced their perceptions of college majors and career choices. Thus, it is important to explore the middle school and high school girls' STEM learning experiences and their perceptions of participating in an OST STEM program. The results of the study may help researchers and educators to better understand how the program can impact students' interests, self-efficacy, and career choices. The combination of SCT and SCCT model, described in this chapter, was further followed as a theoretical framework for this qualitative study, and served as a tool to organize the embedded the cases, in order to answer the leading research questions.

Chapter 3: Methodology

This qualitative study aimed to explore middle school and high school girls' learning experiences of participating in a STEAM program and the influences of the program on their interests, self-efficacy, and career development. In this study, I referenced a single-case study of a STEAM OST program in South Texas called Girls in STEM and used eight embedded cases to explore the following research questions:

Q1: What are middle school and high school Latinas' experiences of participating in an OST STEM program?

Q2: How does the learning experience of participating in an OST STEM program impact Latinas' self-efficacy and interest, especially in STEM fields?

Q3: To what extent does the learning experience of participating in an OST STEM program influence Latinas' career self-efficacy and career interest, especially toward STEM fields?

The purposes of using qualitative study were to understand how people interpret their experiences, how they construct their worlds, and what meaning they attribute to their experience (Merriam & Tisdell, 2015). In this study, as a researcher, I mainly applied Maxwell (2013) to design the qualitative study, followed by Yin (2003) and Stake (1995) to collect and analyze data. I conducted interpretative qualitative study to understand the influences of participating in a STEM program on Latinas and used two research instruments: a personal in-depth interview and an art-based activity. The participants were purposefully selected. They were middle school and high school girls who participated in Girls in STEM program for more than two years. The process of collecting and analyzing data, led to eight embedded descriptive and exploratory cases.

In order to fortify the accuracy of the study, the researcher utilized Maxwell's (2013) rich data, respondent validation, and Stake's (1995) triangulation strategies. The study conducted in accordance with research ethics and the protection of human subjects. Because all the participants are minors, special attention was paid to protect participants during all data collection activities. Research had been carefully conducted to minimize potential bias and subjectivity in the process of conducting this qualitative study.

This chapter outlines the detailed methodology for this study, presenting the research design, describing the site and participants, and defining the purposeful selection; followed by data collection methods and data analysis processes, along with an explanation of the trustworthiness and researcher positionality.

Research Design

Nature of research design. Case studies are the favored research method when the researcher has little control over the process and when the focus is on a contemporary phenomenon within real-life context (Yin, 2013). A case study using empirical research methods explored "a contemporary phenomenon (the "case") in depth and within its real-world context, especially when the boundaries between phenomenon and context may not be clearly evident." (Yin, 2017, p. 15). Furthermore, a case study is the method to "1) cope with the technically distinctive situation, 2) rely on multiple sources of evidence, and 3) benefit from the prior development of theoretical propositions" (Yin, 2017, p. 13). With these two features, the researcher utilizes the case study method to deliver contextual conditions, conduct an in-depth description, analyze of a bounded system (Merriam & Tisdell, 2015; Yin, 2013).

Following Yin (2013) and Stake (1995), a case study approach accommodates my ontological and epistemological assumptions. Case study research acknowledges multiple

realities and presents multiple means (Yin, 2017). It also captures the perspectives of different participants and focuses on how their different meanings illuminate the scope of study. Thus, I embraced the idea of multiple realities and reported different participants' perspectives through multiple forms of research activities. In addition, to better understand participants' perspectives, I built close relationships with participants, captured their meaning through different forms of activities, and created a cooperative environment to evoke more dialogues in my research design.

Rationale for single-case embedded design. A qualitative research design should be a reflexive process, and the selection of a research design depends on the purpose of the study (Maxwell, 2013). In a case study, research questions provide an important clue regarding the most relevant research strategy to be used (Yin, 2003). This research is not simply intended to study what are participants' learning experiences, but also answer how and to what extent the students' self-efficacy and career development have been influenced by the STEM enrichment program. As Yin (2003) suggested, the case study strategy is suitable to answer "how" and "why" questions. Thus, to better explore the research questions in this study, I selected a qualitative single-case embedded design and interpretive qualitative research approach in this study.

Selecting Girls in STEM program as a single case is driven from the researcher's intrinsic interest in exploring the influences of the program on middle school girls, rather than learning about other cases or about general problem (Stake, 1995). Following the theoretical framework, the researcher developed a clear set of propositions as well as the circumstances in the case study, which helped present the uniqueness of Girls in STEM program. These propositions directed attention to the context in a case study that should be examined within the scope of

study (Yin, 2003). By stating propositions, the study not only described the cases but also explored Latina's STEM interests, self-efficacy, and career development.

Embedded design can identify logical subunits, present more measures or data, and avoid unsuspected orientation which occur in holistic design (Yin, 2013). According to Yin, the subunits in embedded design can often add significant opportunities for extensive analysis, enhancing the insights into the single case. Thus, the researcher used "embedded units of analysis" to explore eight representative girls' experiences, catch the complexity of participants' behaviors relates to the program contexts, and looks for the interaction within this case study (Yin, 2003, p. 40). Figure 4 presents the overview of embedded case-study design. Information about each unit of analysis would be collected. Propositions would help to identify the relevant information about each participant and to select what should be covered in the case study within the study context.

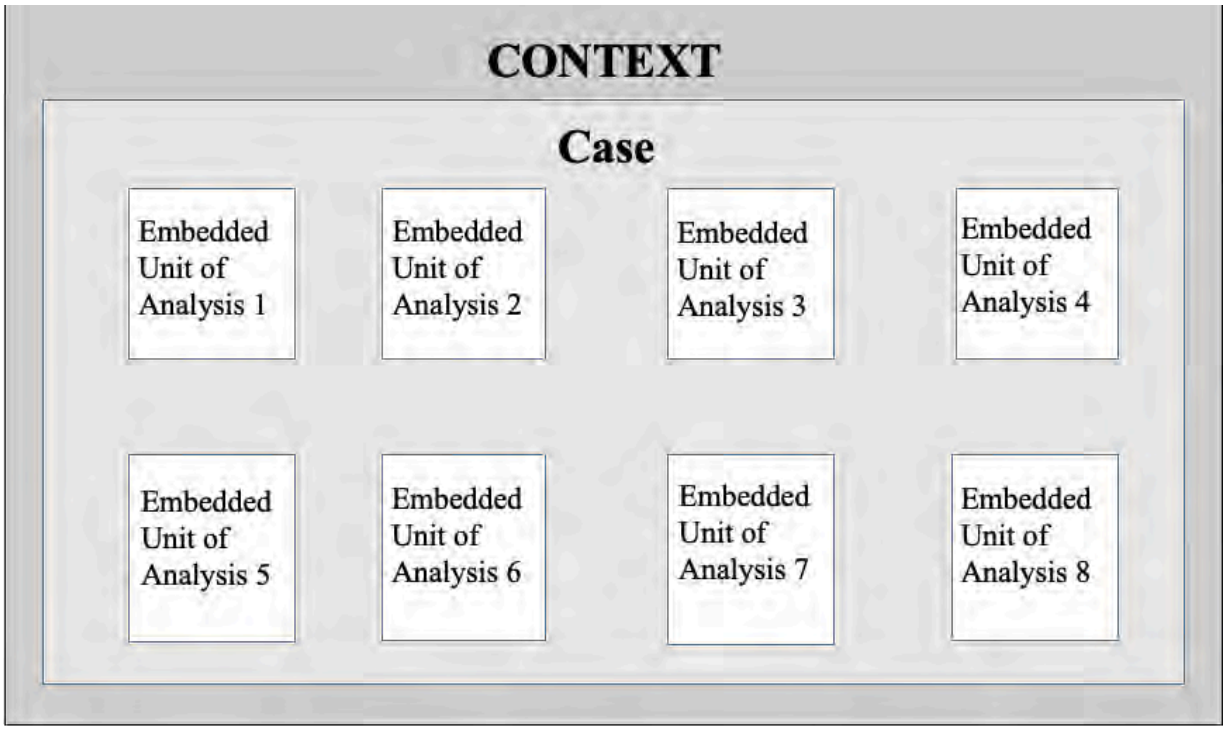

Figure 4. Embedded case-study design.

Additionally, a case study is a useful approach to collect multiple sources of information (e.g. observations, interviews, audiovisual, material, and documents and reports) and to gain an in-depth understanding of the case (Creswell & Poth, 2018). Using a case study approach meets the researcher's ontological assumption that the reality can be seen through different views. Participants' different perspectives should be captured through different forms of activities and different experiences. As Yin (1993) demonstrated, to ensure the richness of the context in a case study, the researcher cannot rely on a single data collection. Getting multiple resources helped the researcher gain an in-depth data collection, interpreted the data from multiple realities, and reported a case description and case themes (Creswell & Poth, 2018). Thus, using qualitative case study methods with single embedded case design is suitable for collecting multiple sources of information, describing participants' experiences, and exploring the research questions.

Site and Settings

Overview of Girls in STEM program. Girls in STEM program was launched at a faith-based private university in South Texas in 2015. This private university is a Hispanic-serving institution and offers degree programs from Baccalaureate to Doctoral. The mission of Girls in STEM program is to inspire and empower girls to be innovative and passionate about their future in the fields of STEAM through creating an engaging, relevant, and challenging learning environment (Wang & Frye, 2019). The program provides free robotics and STEM learning opportunities to middle and high girls, with a special focus on targeting students of color from Title I public schools. Those Title I schools have high numbers or high percentages of students from low-income families and need financial assistances from local education agencies (U.S. Department of Education, 2019).

During the past five years, Girls in STEM, the program has evolved fast and started to recruit high school girls (9th to 12th grades) in 2019. In the summer of 2019, the program consists of one middle school level STEAM summer camp (called miniGirls) and two high school level STEAM camps (called megaGirls and megaResearch). The program also hosts robotic clubs (called miniRobots) in elementary and middle schools through the academic year and sponsors girls in the club to participate in First Lego League (FLL) Challenges at the same time. Table 2 shows an overview of Girls in STEM program and provides the information on grade level, curriculum, and staff. The following presents the detailed information about each program and activities in Girls in STEM program.

Middle school summer camp. MiniGirls is a free two-week summer camp with a special focus on engineering and programming. The summer camp was hosted at the university and supported by an Autonomous Vehicles System (AVS) Lab. The goal of miniGirls is to introduce more middle school girls into the fields of STEM through robotic projects, computer programming, graphic design, along with guest speakers. In 2015 and 2016, miniGirls summer camp started as a one-week STEM summer camp, it became a free two-week STEAM and programming camp held four separate times in 2017 and 2018. The additional integration with arts, provides more learning opportunities and real-world contexts which meet more students' interests. MiniGirls also cooperates with public school teachers, undergraduate and graduate students, camp counselors, guest speakers, and high school mentors, aiming to provide better mentorships and assistantships for middle school girls. The curriculum includes multiple STEM projects and hands-on activities which related to chemistry, meteorology, programming, nutrition, and art. The Lego Mindstorms EV3 robots serve as a platform for girls to learn about

robotics, sensors, and computer programming. Table 2 presents the overview of Girls in STEM program.

Middle school robotic club and robotic competition. MiniRobots is a full-year robotic club which views as an extension of miniGirls summer camp. It is an all-girls robotics club sponsored by Girls in STEM and held for middle school girls at a public school that is classified as Title I. MiniRobots started at Treviño Middle School, which is a Title I public-suburban middle school campus in the Central Downtown Independent School District (CDISD) in South Texas. The purpose of the club is to increase middle school girls' STEM interests and programming skills. In 2018 to 2019 season, miniRobots organized and sponsored the first FLL all-girls team at Treviño Middle school. In 2019 to 2020 season, Girls in STEM program is organizing and sponsoring four teams in CDISD. Middle school girls participate and program EV3 Lego Mindstorms robots during their class periods and weekend at their schools. College students in STEM majors and school teachers are serving as mentors for local FLL teams.

Table 2

Overview of Girls in STEM Program

Grade Level	Name	Curriculum Concepts	Staffs
Middle School (6th to 8th) High School (9th to 12th)	miniGirls Summer Camp megaGirls Summer Camp	• Two-week STEAM curriculum include: • Robotics • Block coding and Python programming • Game design • Engaged hands-on STEM activities • Career Exposure and guest speakers • Nutrition and gardening hand-on activities • Combination of Art activities into STEM curriculum	• University faculties from engineering, computer science, and nutrition fields. • School teachers and social worker • Undergraduate and graduate assistants • Camp counselors • Guest speakers from different organizations and fields.
High School (9th to 12th)	megaResearch Summer Camp	• Six-week STEAM curriculum includes: • Individual or group research-based projects • Academic writing course and presentation training • Other STEAM hands-on activities	
Middle School (6th to 8th)	miniRobots Robotic Club & competition	• Weekly hands-on robotic programming practice • Lego EV3 Robotic Competition and First Lego League (FLL) Challenges	• School teachers and social worker • Undergraduate and graduate assistants

Note: Some of students in miniRobots program may also be in the miniGirls summer camp.

High school research summer camp. MegaResearch is a six-week summer camp for high school juniors and seniors which launched in 2019. The purpose is to provide the high school campers a longer time to explore science and engineering through a faculty-supervised, hands-on research project that interests them personally. In the megaResearch camp, the PBL approach and hands-on STEAM experiences were applied to encourage cooperative learning and build a positive learning environment. The girls in the megaResearch are treated as undergraduate students by giving a sense of liberalism to organize and manage their own time to work on their projects. This flexibility was given to them to create interest in choosing the STEM major in their future endeavors. At the end of the six-week, they present their work with their team or individually to peers, university faculties, teachers, and college mentors.

In summary, Girls in STEM program was launched in South Texas, where has 63% Hispanic population (Statistic Atlas, 2018). The program mainly focus on providing more STEM learning opportunities for middle school and high school girls from Title I public schools in South Texas. The program included different kinds of summer camps during summer and robotic clubs during the academic years. The program connected school, community, and university by cooperating with college students, high school mentors, parents, and school teachers.

From 2018 to 2019: Demographics information of girls in STEM. The demographic represents the research population in this study. As shown in Table 3, miniGirls summer camp recruited 139 middle school girls from 19 schools in South Texas in 2018. While, a total of 153 middle school girls were recruited from 44 schools in 2019. megaGirls Summer camps were hosted for the first time in summer 2019 with a total of 63 campers attending from June to August, 2019. Among all high school participants, 14 girls attended six-week megaResearch, while the rest of them participated in the two-week megaGirls summer camp.

As showed in Table 3 and 4, we find that Girls in STEM program had a high ratio of Hispanic participants in all programs. The incoming 6th graders took the largest part in the miniGirls summer camp, while the majority of megaGirls campers were incoming 9th graders. The student population in each program is increasing and becoming more diverse.

Table 3

Demographic Information for miniGirls 2018 Summer Camp

	# of enrollment	Grade6 (%)	Grade7(%)	Grade8(%)	Hispanic(%)	English as Primary Language (%)
Camp1	35	0	31	69	97	74
Camp2	30	30	37	30	87	77
Camp3	38	50	18	32	89	55
Camp4	36	42	44	14	72	94

Table 4

Demographic Information for miniGirls 2019 Summer Camp

	# of enrollment	Grade6 (%)	Grade7(%)	Grade8(%)	Hispanic(%)	English as Primary Language (%)
Camp1	29	38	24	38	93	72
Camp2	29	3	62	34	72	86
Camp3	45	62	29	9	87	51
Camp4	50	56	12	32	34	78

Curriculum: using project-based learning as the pedagogy. PBL has a close association to STEM fields. In STEM education, it is essential for students to connect the

"school" knowledge to real world and understand the importance of contents to their lives, which in turn may raise their attitudes towards STEM subjects (Wang & Frye, 2019). Researchers have applied PBL into the design of STEM inventions in many ways, while many of these studies have positive influences on students' learning. In the curriculum of Girls in STEM, PBL is used as a pedagogy to offer students more hands-on opportunities and help students connect the contents with the real-world situations. Table 5 presented the timeline of curriculum in the summer camp. The following are detailed introduction of high impact STEAM activities in the camp.

Introduction to engineering. The activity of "Oil Spill Clean Up" was aimed to teach students how to use natural resources effectively with minimal wastage. If there is unexpected event happened in our environment in related to Oil spill, it aims to teach students how to think like an environmental engineer and oil company owner to take effective and efficient measures to save our environment and keep it safe for living. Students were broken down into teams and asked to create the scenarios to recreate the oil spills. Once they have successfully created, they were asked to try different methods for cleaning them up and taking effectiveness and cost into consideration. After they have finished these two steps, they analyzed the scenarios to learn more about it. While in the process, students learn how to keep our environment safe.

Introduction to science. Students make slime and elephant's toothpaste to study the basic concepts of mixing different elements and observe their reactions in a fun and entertaining way. After doing the slime, students were introduced what will happen if different elements are mixed and how the output will be entirely different. In this activity, students were exposed to the various effects of different chemical reactions which allow them to experience how science can be interesting and fun.

Introduction to robotics. Lego Mindstorms EV3 Programming was aimed to teach middle school students' math and robotics concepts where they would get a chance to learn how to design, build and program their own EV3 Lego Mindstorms Robot. Lego Mindstorms Robot is the most common, widespread platforms for learning basic engineering and programming skills in schools. Affordable LEGO Mindstorms robots were widely introduced in K-12 STEM education, and programming training was integrated into these programs as well. Students were exposed to EV3 block-based programming and get a chance to use MATLAB scripting. Once they have designed and build their own robots, they were asked to program the robot to achieve specific tasks like driving through a maze by avoiding the obstacle and compete against other robots. After that, they were asked to play the music on EV3 robots.

Introduction to technology. Game design activity and programming were aimed to teach students game design and programming using visual block-based programming. In this activity, students are being exposed to programming in a fun way by using video games. They were given a task to design the game where the player moved to target location by avoiding the obstacles. A manual was provided to create the path for the player to reach target. The purpose of this activity was to get introduced to programming using visual block-based Programming. In the summer of 2019, Python programming was selected to introduce fundamental programming concepts for high school girls in this study. The eight-session Python programming course created a fun and interesting learning environment, which helped expand students' pervious knowledge about and programming and increase their interests in computer science.

Introduction in using art with science and engineering. Girls in STEM curriculum integrated art into different activities, such as sound recording and music instruments. Storytelling, clay boat, and toothpick towers are typical hands-on activities to show how the

program combined art with science and engineering. In the storytelling activity, students were grouped and asked to create storyboarding about the camp by adding their story to it. Once the storyboard was created by each group, students were asked to use the song “a Million Dream” as a background music and present the story with their experiences in it. Furthermore, a clay boat activity was aimed to teach science, by combining art with it. In this activity, the students are given a small amount of clay and asked to make boats that float in a tub of water without sinking. In order to successfully complete this task, students design the clay boat by taking its density, mass and buoyancy into consideration to make the boat float. Moreover, “toothpick towers” was designed to integrate art and civil engineering in creating prototypes. It also gives the girls a chance to think creatively, as well as develop problem solving and teamwork skills. This activity involves designing a blueprint, thinking innovatively, collaborating with team members.

The curriculum of Girls in STEM program integrated different parts of science, technology, mathematics, engineering, and arts. Hands-on activities and project-based learning were utilized with an intention to increase girls’ increase in STEM and develop related skills. In the summer of 2020, nutrition and gardening will continuously provide students more exposure to different fields. More effort will be made to create a fun and integrative STEM learning environment and community for middle and high school girls. Girls in STEM program is also trying to integrate artificial intelligence (AI) and advanced programming language training into the high school curriculum, which may provide essential programming skills to build STEM career pathways.

Table 5

Overview of Girls in STEM Summer Program Curriculum

	Monday	Tuesday	Wednesday	Thursday	Friday
Subjects	Science	Technology	Engineering	Robots	Programming
Week1	○ Icebreaker ○ Make slime ○ Toothpick towers ○ Egg Drop ○ Elephant Toothpaste ○ Journaling ○ Newspaper Tower	○ Intros to EV3s ○ Programming and Coding ○ Building Robots ○ Programming ○ Sumo Wrestling ○ Journaling	○ Energy ○ Meteorology ○ Straw bridges ○ Clay boats ○ EV3 Robot ○ Programming ○ Journaling	○ Bionic Fish ○ Graphics design ○ Guest speakers ○ Journaling	○ Programming and game design ○ Journaling
Introduction	The first five days of each summer camp focuses on exploring the STEM fields and introducing the campers and STEM teachers to the field of computer programming through the Lego Mindstorms EV3 robot and the Scratch Programming Language. During this time, the campers form groups and begin to design a robot that can meet the robot challenge that is held during week two of the camp session.				
Week2	○ Food science ○ Guest speaker ○ Journaling	○ Programming ○ First Lego League Obstacles	○ Yoga ○ Music Singing ○ Astronomy ○ Guest speaker ○ Journaling	○ Building and Programming robots ○ Robotic competitions	○ Rollercoaster design ○ Clay boats ○ Nutrition ○ Gifts and awards ○ Journaling
Introduction	In the second week of each camp session, campers spend four days using the MATLAB programming language and learn the basic syntax for coding simple programs that can perform such operations as plotting math equations, performing arithmetic operations, and solving algebraic equations. Additionally, the campers work on the Lego EV3 which culminates in an advanced challenge which requires the use of sensors, closed- loop feedback, and structured real-time programming.				

The uniqueness of girls in STEM program. The Girls in STEM program has been selected as a single-case study for its particularity, uniqueness, and complexity in the following three ways (Stake, 1995). First of all, Girls in STEM program does not require any fees and provides free transportations for all the students to overcome the economic barriers. Although there are some STEM programs in South Texas (e.g., iD tech, Interactive Technology Experience Center, SASTEMIC), not all of them are free and specially design for middle school girls who are studying in Title I public schools (iD Tech, 2018; Saygin et al., 2012). The project-based learning environment helps students to translate abstract mathematics and science concepts into concrete real-life applications, and connects areas (e.g., music) that typically seem disconnected with STEM subjects. In this OST program, many participants stated the single-gender learning allowed them to ignore the gender differences (i.e. boys' negative behaviors), become relaxed (i.e. speak louder), and build a sense of fit in STEM subjects (i.e. express more on robotics and engineering topics) (Wang & Frye, 2019).

Secondly, the Girls in STEM program particularly serves students from Title I school districts and schools. The Title I schools and school districts in this study have high percentages of students from low-income families and high ratio of at-risk students (U.S. Department of Education, 2018). Taking the Treviño Middle School as an example, the school has 94.2% of economically disadvantaged and 81.5% of students were considered at risk of dropping out of school (Texas Education Agency, 2017).

Lastly, most of participants in this case study are Latinas and did not have many opportunities to learn robotics and engineering in their school classrooms. As data showed in miniGirls summer camp 2018, 76.3% of girls stated their Hispanic racial identity and believed they belonged to the Hispanic culture (Wang & Frye, 2019). The reasons included their Mexican

heritages, family origins, languages, and cultural traditions. The majority of the campers did not know any scientists and engineers among their friends and family members. Most of them did not have prior STEM camp experiences other than the miniGirls program.

The case for this research was determined by the purpose and the needs of the study. Considering all of the information and uniqueness, Girls in STEM was found appropriate to conduct the study. In the chapter that follows, I describe more details of participants, data collection and analysis, the trustworthiness of the design, and my positionality within the ecology of the research site.

Purposeful Selection: Sample, Participants, and Unit of Analysis

Followed by the case study design, the researcher purposeful sought in-depth information from embedded "unit of analysis" which represents eight participants in the study (Yin, 2003, p. 23). Not all the participants in the STEM program are selected for the study, because the researcher wants to collect data extensively from each of the participating experiences rather than merely understanding the whole case (Yin, 1993). Propositions examined the scope of study and helped the researcher to identify the relevant information about each participant. Based on the research questions, relevant information about each individual has been collected and individual is the primary unit of analysis. Selection of the appropriate unit of analysis is important that the researcher needs to find the persons, places, and occasions which "best help understand the case" (Stake, 1995).

The sample for this study consisted of 41 middle school and high school girls (grade 7th to 12th) who had long-term participation experience in the program. I defined the "long-term" as participating in Girls in STEM program for more than two summers or two academic years. During March to August, 2019, 15 girls completed at least two in-depth interviews, 36 girls

participated in cooperative art-based activities, and 10 girls finished both interviews and art-based activities. Among all these participants, a total of 30 participants reported their ethnicity as Hispanic, which consisted of 73% of all participants.

My selection of particular participants in this study considered two factors, the length of participation and the engagement during the data collection. First, I selected participants who were active members and had long-term experience in the Girls in STEM program. Their experiences enabled me to present my sample population and overall situation of the case. The data from interview and art-based activities was sufficient to cover themes and propositions in this study which helped answer the research questions. The second consideration was the type of the data I collected. During the data collection process, my position as a graduate assistant in Girls in STEM program gave me access to conduct interview and art-based activities when students were in the summer camps. Two data collection approaches were used with some participants, but some of them only finished one of the activities. Interviewing was the main data collection method, while art-based activities provided additional information and served as a catalyst to evoke more conversation for interview. Thus, I tended to select participants who participated in both data collection methods.

After the purposefully selection, eight participants in Girls in STEM program had been selected to present as the embedded case studies. Table 6 presents the information of eight embedded cases. As we can see, these eight students were all Hispanic and had at least 2-year participation experience in Girls in STEM program. Among eight girls, five were participated in the art-based activities along as interviews.

Table 6

Information of Eight United of Analysis

Name	Grade	Ethnicity	Primary Language	Experience (years)	Data Collection
Elisa	7th	Hispanic	English	2	Interview/Art
Felisa	8th	Hispanic	English	3	Interview
Amada	7th	Hispanic	English	2	Interview/Art
Ariana	8th	Hispanic	English	2	Interview
Nora	9th	Hispanic	Spanish	2	Interview/Art
Savanna	11th	Hispanic	English/Spanish	3	Interview/Art
Clara	9th	Hispanic	English	3	Interview/Art
Reya	7th	Hispanic	English	2	Interview

Introduction of participants' school districts. Participants were from Central Downtown Independent School district (CDISD) and South ISD (SISD). These two school districts had similar demographic and presented same challenges in students' achievement and performances. Looking at the demographic information, both school districts have a high ratio of Hispanic students, 90.3% in CDISD and 91.6% in SISD (Texas Education Agency, 2019). From the past two academic years, both school districts increased their overall performances, but still gained a B and a C in overall academic performance from the Texas Education Agency. Furthermore, both school districts rated a C in student achievement and performed lower than state level in numbers of students who approached master level and met grade level. According to Texas Education Agency (2019), CDISD got 62 out of 100 in the STAAR performance, whereas SISD had 59 out of 100. Moreover, both CDISD and SISD got C in closing the gaps

between different ethnic groups. Although Hispanic is the dominated ethnicity group in both school districts, Hispanic students achieved lower than White and Asian in academic achievement, growth, and student success. Whereas, Hispanic students got higher achievements than African American students in academic achievement and students success. Thus, in both CDISD and SISD, more attention needs to be paid to improve Hispanic students' academic achievement and students' growth.

Participants' profiles. The following are eight selected participants' profiles.

Elisa, a 12-year-old Hispanic girl, was studying in 7th grade in SISD. She participated in miniGirls summer programs in 2018 and 2019. Elisa enjoyed music and liked playing different music instruments. She often played ukulele and sang songs with other girls during the lunch break in miniGirls summer camps. Elisa actively engaged in the interviews, describing her learning experience in the miniGirls and offering her opinions of her community and the school.

Felisa, a 14-year-old Hispanic girl, was studying in 8th grade in CDISD. She has been a member of Girls in STEM program for three years. During this period, she actively participated in miniRobots and miniGirls summer camps, where she gained her first programming experience. During the interviews, she shared her opinions of Hispanic culture and her family values. Although she is a Latina, she did not fully consider Hispanic culture as a part of her own culture. Being the oldest kid in her family, she is expected to be a role model and take care of the other kids. These values might affect her expectations to the future and behaviors to achieve goals.

Amada, a 12-year-old girl who was studying at SISD. She was confident in her math and science abilities because she always got good grades in these two subjects. Amada was interested in playing basketball and wishes to turn her interests into a career in the future. As she mentioned

in the interviews, she wanted to become a basketball player for WNBA, but she needed more practice to achieve better performance.

Ariana, a 13-year-old Hispanic girl who was studying in CDISD. She moved from another state when she was little. She was an active member in Girls in STEM program, and joined in miniRobots for one year and participated miniGirls summer camps two times. She actively engaged in the interviews, sharing her learning experiences, expressing her interests and learning preferences, and offering her opinions of the community, school, and family support. As Ariana mentioned, she was interested in science-related hands-on activities and confident in her science performance in school. In the process of learning, her teachers helped a lot to push her forward, awaken her interests, and exclude negative impact from others. Her mom was supportive by providing related resources.

Nora, a 9th grade high school girl who was studying in CDISD. During her middle school years, she was an active member in miniRobots and miniGirls summer camps. In the summer 2019, she participated in megaGirls, the high school level summer camp. As a rising high schooler, Nora felt stressed, but still optimistic about her new school. When we talked about her future plan, she expressed that she liked to see different possibilities. Although STEM was interesting for her, she might not persist in pursuing STEM in the future.

Savanna, a 16-year-old Hispanic girls, studying in 11th grade in CDISD. She participated in miniGirls summer camps since 2016. Savanna witnessed the development of the program and also recommended her friend to the program. As she expressed, the curriculum was getting better and became more open to different disciplines. In the summer 2019, she was working on her own research project in megaResearch and enjoyed coming back as a member in Girls in STEM.

Clara was in 10th grade, studying in SISD. She started to participant in miniGirls summer camp when she was in 6th grade and was the president of miniRobots at Treviño Middle School. In the process of learning, she became more interested in working with robots, making video games, and doing robots' competitions with other girls. As a high school student, she studied hard and kept good scores in order to keep enrolling in different educational programs.

Reya, a 7th grade Hispanic girl, studying in SISD. She was interested in learning programming, technology, animations, and art design. During the interviews, we talked about a wide range of topics which related to self-efficacy, family influences, interests, and career development. As Reya mentioned, her uncle played an important role in supporting her to learn STEM. Under the influence of her uncle, she realized getting practical experience was as important as getting a college degree. So, she was excited to get hands-on experiences and learn more about programming, animation, and technology in STEM program.

Intending to provide different perspectives, I selected eight middle school and high school girls as embedded cases. Three out of eight participants enrolled in high school and the other five were studying in middle school. All of the participants decided to voluntarily participate in the study.

Data Collection

Description of data collection practices. The following is a brief overview of my data collection practices. The data for this qualitative study mainly consisted of in-depth interviews, presentations from art-based activities, and visual arts. The core of interviewing is to understand the experience of participants and the meaning they expressed from their experiences (Seidman, 2005). By combining with art-based activities, the study had a better presentation of the influences of the program on participants' interests, self-efficacy, and career development.

Among eight girls, five were participated in the art-based activities along as interviews. The remaining three only finished interviews.

The data collection and analysis for this case study of Girls in STEM program began with a "getting acquainted phase" (Stake, 1995, p. 49) in April and May, 2019. This phase was followed by intensive data collection from June through July. Data collected during this time included: review documents, collect documents, interviews with middle school and high school girls, and art-based activities. I started to contact site teachers, potential participants, and students' parents on February, 2019. At that time, I was discussing my ideas with peers, reviewing my research design, and requesting consent letters with site teachers, potential participants and their parents. Until the last week of April, I conducted my first interview with Ariana. From the three-time interviews with her, I was able to learn from her perspectives and revise my interview strategy. Starting from June, I was able to visit more participants who were participating in Girls in STEM summer camps. I spent the rest of month of June and July interviewing the girls who have long-term participation experience, as well as conducting art-based activities with other girls who met selection criteria. These three stages of research and the tasks that I engaged in during them, can be found in Table 7. Table 7 includes an overview of the data collection process from April 2019 to July of 2019.

After each visit to my participants, I tended the data I had gathered. I wrote my observations and memos after each interview and activity. These notes focused on participants' family life, culture influences, and camp experience, which gave me the first sight of who were the participants and what were their experiences. I treated analysis as a part of design, so I adjusted interview questions and changed the sequences of data collection activities for several participants. I made interview transcripts by using Temi and made photocopies of students'

drawings, labeled them by identifying information, and placed them in a folder. All of the data I collected, including audio-recording and hard-copies, were stored in my personal computer with a password. Transcripts and memos have been uploaded to Dedoose. The following parts provided more information about interview process and art-based activities.

Table 7

Stages of Research

STAGE 1: Preparation	STAGE 2: Acquaintance	STAGE 3: Intension
February – April 2019	April – May 2019	June – July 2019
Discuss ideas Explore research design Requesting consent letters and school district approval	Three-series in-depth interviews	In-depth interviews Art-based activities
Initial preparation	Initial analysis, memo writing	Ongoing analysis, memo writing, selection of embedded units of analysis

Data collection instruments. In this study, there were two data collection instruments which collected audio, text, visual arts. Interviewing was the main data collection method, while art-based activities provided additional information and served as a catalyst to evoke more conversation for interview. Depends on the available of the participants, they were not required to participate both data collection activities and followed the sequences of the data collection process. Thus, five out of eight completed the art-based activities along with interviews. Among these five girls, two of them conducted the art-based activities first, while the remaining three finished interviews first. The following part presented more details about each data collection instrument.

In-depth interview. In qualitative research, there are a wide variety of strategies and techniques for interviewing. Interviews also vary from structured survey interviews to unstructured conversation. I relied on semi-structured interviews with open-ended questions as the major source, to gain participants' experiences within the research scope (Maxwell, 2013). The researcher used three-interview series and treated all interviews as opportunities to have participants reconstruct their experiences within the study contexts (Seidman, 2005). The first part of the interview focused on understanding on the social, family, school, culture influences on self-efficacy and career development. The second part focused on the boundary of the case, and explored the details of program experiences on self-efficacy, interests and career development. The last part collected supplemental answers if necessary. The data from arts-based activities helped to adjust interview questions. A semi-structured interview was conducted with all participants. The interview questions can be found in Appendix A and Appendix B.

According to Salman (2015), in-depth interviews are a qualitative research technique that involves a researcher guiding an interviewee to obtain information, and collects their perspectives, insights, perceptions and experiences within the scope of the study. With the interviewee's consent, individual in- depth, face-to-face interviews are usually thirty to ninety minutes in length, and are recorded by the researcher, considering the research ethics and protection of human subjects (Graham, 2000; Seidman, 1998; Van den Berg, 2004). Considering the participants were all middle school and high school students, each interview took fifteen to twenty minutes in this study. After conducing primary interviews, the researcher read and thought about interview transcripts and observation notes and wrote memos. Then, follow-up interviews were conducted to get a deeper and clearer understanding of participants' responses. The follow-up questions were built upon the primary interview. The length of the follow-up

interview depended on several factors, such as the topic, the researcher and the participant (Gill, Stewart, Treasure, & Chadwick, 2008). The length of the follow up interviews in this study averaged between ten to fifteen minutes

All interviews have been audio-taped and transcribed into texts by using Temi. I also checked the transcripts and corrected the errors manually. Observations during the interviews such as laughing, hesitation, or facial expression have been included as notes to analyze data and study participant's behaviors (Vagle, 2017). After each interview, the researcher transcribed the interview immediately. Reviewing the interview transcript helped the researcher adjust the interview strategy and revise the follow-up interview questions.

Art-based activities. Arts-based activities are most commonly used in the study to "explore, describe, evoke, provoke, or unsettle" (Leavy, 2017). Drawing or storytelling is also common in work with children, because it can help adults connect ideological abstractions to specific situations (Huss & Cwikel, 2005). The researcher believes drawing is a useful tool to work with children, explore participants' awareness of self and other, and express girls' emotions and imaginations (Leavy, 2017). Visual art served as an additional data source for this case study. In drawing activity, girls are empowered to create and explain the contents of the research. So the relationship between researcher and participant is more equal (Huss & Cwikel, 2005). In this study, the drawing prompted designs to capture different participants' experiences in the program, which may relate to the development of their self-efficacy, interests, and careers. Furthermore, participants' art was able to act as a catalyst to focus and guide follow-up interviews (Driessnack & Furukawa, 2012).

To achieve these goals, the researcher provided different sizes of paper and an assortment of pens and markers to participants. The drawing emphasized the process of expressing

themselves through art rather than the quality of drawing and the display of talent. In the first stage, three to five participants seated together in a round table to make paintings individually. They were asked to create three separate pictures to describe 1) your experience in Girls in STEM program, 2) your future or dream career, and 3) your life. After completing the drawing, participants were asked to share their pictures with others. Participants presented their pictures with a clear description to all people. The researcher recorded their presentation. After the presentations, participants have rights to review and redraw the pictures if they need more clarification (Huss & Cwikel, 2005). Table 8 presented each instrument, purposes, and number of participants in each activity.

Table 8

Data Count

Type	Forms	Approach	Purposes	# of Participants
Interview 1	Audio-recording; Transcripts	Face-to-Face in-depth Interview	Focused on life and culture influences on self-efficacy and career development	15
Interview 2			Focused on the details of camp experience on self-efficacy, interests, and career development	15
Interview 3			Collect Supplemental answers if necessary	3
Art-based activities	Visual Arts; Photocopies; Narratives; Audio-recording; Transcripts	Drawing pictures; Group discussion	Design a cooperative study environment to collect participants' learning experience within the case	36
Attending both Interviews and Art-based activities			Triangulation	10

Data Analysis

Qualitative case study research seeks to present the texture and depth of a case with as much attention to detail as possible. Data analysis for this study was conducted according to the data collected. The actual data analysis will follow through the entire research process from "the first impressions as well as to final compilations" (Stake, 1995).

My data analysis followed Stake (1995) and Yin's (1993) data analysis strategies. I used constant-comparative (Corbin & Strauss, 2008) method to compare participants with different backgrounds and heavily relied on an understanding of themes and propositions presented in the study. This method allowed me to continually compare the differences of each participant and the extent of influence on participants based on their backgrounds. It also helped me to increase my understanding of the scope of the case and manage the different forms of data that I was collecting from my data collection activities.

During the period of June to July, I got three forms of data: in-depth interviews, presentations in art-based activities, and visual arts. The first two types of data were audio-recorded and are translating by Temi software. To ensure the accuracy, the researcher made the final correction for the transcripts. Furthermore, during the data collection, the researcher wrote analytical memos for each participant and each activity (Maxwell, 2013). Each memo has been coded in Dedoose, which helped the researcher to find possible codes and themes and provide extra documents to construct meanings. These memos helped the researcher categorize and connect with prior themes. They also served to reveal gaps between prior categories and emerging themes. The following presents the three stages of data analysis in this study. Beginning with the content analysis, which focuses on analyzing text and documents. Then, the data analysis involved in thematic analysis, with a special emphasis on developing themes. The

last phase pays more attention to the selection of units of analysis and emphasizes comparison and triangulation of data.

First stage of data analysis: coding. The purpose of the first stage is to create themes that effectively described the STEM learning experiences and research-related concepts. Initially, the researcher read all transcripts over and over again and get familiar with the data. I used prior themes and memo-writing as a way to explore all possible emerging themes. The transcripts of interviews and narratives of art-based activities had been imported into the Dedoose, which helped me with data management, coding, and analysis. Then, the researcher used constant comparative analysis to make comparisons of different participants, different times, and different data types. For instance, the researcher compared two interviews and art-based activities, from the same participant to determine the participants' perceptions. As for the art-based activities, I separated it into two parts, the records of presentations and visual arts. According to Leavy, most of the arts-based visual research is still disseminated in the style of traditional research, which means that the visual is still transformed into text. Thus, in my data analysis, I followed the coding process to deal with the presentation records. For the visual art, I gave the explanations to each picture and connected the visual art with the themes to present the results. The following presented the codes followed by the descriptions of the coding.

Second stage of data analysis: thematic analysis. The purpose of the second stage was to connect the theoretical framework and make meaning of all the data. I followed the theoretical propositions to select certain data and to ignore other data (Yin, 1993). As stated by Yin, the theoretical propositions helped the researcher "organize the entire case study and to define alternative explanations to be examined" (p. 112). In this step, I followed the theoretical framework to code interview transcripts, presentation transcripts, and memos through line by line

to create a matrix of categories and place the data within such categories (Yin, 1993). Three coding cycle are involved: 1) initial coding, also called open-ended approach, allows the researcher to develop all possible initial codes, 2) selected coding allows me to generate selected codes based on the theoretical framework and other themes from the first stage, 3) emerging coding.

After putting the data into certain categories, emerging themes allowed me to aggregate all the categories and thoroughly make sense of the case (Stake, 1995). Finally, as Stake showed, the researcher will parse all types of data and "put it back together again more meaningfully" (p.75). After completing the thematic analysis, I repeated the same procedure with the data analysis for all participants. During this process, I made sure to carefully treat the data from each individual participant on an individual basis. Table 9 presented the all selected and emerging codes in this study, following by the explanations of each code.

Table 9

Data Codes

Emerging Codes	Selected Codes	Descriptions
Environmental Factor	◊ Family perspectives of STEM ◊ Influences from friends ◊ Influences from teachers ◊ Other girls/people's perspectives of STEM ◊ STEM learning in school ◊ Social support from family, school, and teachers ◊ Description of girls' life	Aspects of the environment or setting that influence the individual's ability to successfully complete a behavior (i.e. Make environmental conditions conducive for improved self-efficacy by providing appropriate support and materials).
Behavioral Factor	◊ Advanced study and post-secondary school plans ◊ How to achieve career goals ◊ Motivation factor	An individual receives after they perform a behavior (i.e. Provide chances for the learner to experience successful learning as a result of performing the behavior correctly).
Personal Factor	◊ Factor impact career interests ◊ Girls' perspectives ◊ Girls' perspectives of gender differences in STEM ◊ Girls' perspectives of school, community, living environment ◊ Girls' perspectives of STEM ◊ Girls' self-perceived STEM abilities ◊ Identity/Beliefs • Culture identity—being a Latina/Hispanic girl • Group identity—being members in program • STEM identity—being in STEM fields ◊ Personal learning interests ◊ Personality ◊ Latino role model	Whether the individual has high or low self-efficacy toward the behavior (i.e. Get the learner to believe in his or her personal abilities to correctly complete a behavior.

Learning Experience in an OST STEM program	◊ Learning outcomes ◊ Perspectives of activities in the program ◊ Working with all-girls ◊ What is an OST STEM program? • Differences between school • Differences between each program	Participants' perspectives of learning experience which related to learning environment, outcomes, activities, and differences between other programs.
Self-efficacy	◊ Influences of program on self-efficacy ◊ Mastery experience • Challenges in an OST STEM program • Success or negative experience in an OST STEM program ◊ Physiological states ◊ Verbal persuasion • Influences from teachers • Encouragements from others ◊ Vicarious experience • Influences/observing from others girls in an OST STEM program	Participants' self-efficacy, influential factors, social and program influences on self-efficacy.
Career interest	◊ Family influence on career development ◊ Career aspirations ◊ Challenges to achieve career/future goals ◊ Influence of an OST STEM program on career • Influence on career development • Influence on career interests ◊ Reasons to achieve certain careers	Participants' career interests, influential factors, social and program influences on career development
Outcome expectation	◊ Expectation from program learning experience ◊ Self-expectation ◊ Expectation from social environment	Participants' learning expectation, standards, social and program influences on outcome expectation.

Third phrase of data analysis: selection of united of analysis. Throughout my data analysis, case analysis strategies and techniques were applied, which allowed me to treat the codes fairly, to draw convincing objective conclusions, and to eliminate alternative interpretations (Yin, 2013). The first strategy is to follow the theoretical propositions that help me better understand the cases. I reviewed memos and selected all codes related to the theoretical propositions, such as self-efficacy, vocational interests, career development. A second analytic strategy is to define and present the eight unit of analysis, which can best present and answer three research questions. With the intention to provide different perspectives, I selected eight middle school and high school girls as embedded cases. Three out of eight participants enrolled in high school and the other five were studying in middle school. They presented different background information and demonstrated different learning experiences from various perspectives. The length of participation and the engagement during the data collection activities are two major factors that I considered when I selected the embedded cases. A third analytic strategy is to develop a case description and exploration by combing the data from interviews and visual arts. In the process of developing the case, I combined the interviews transcripts, audio-recording, and drawing from art-based activities. To present the results and answer research questions, examples were selected from 41 participants, which were presented in Chapter Five.

In the third phrase, I focus more on deepening the understanding of the materials, polishing cases, and completing triangulation. According to Tracy (2010), triangulation is vital to provide multiple views, increasing the scope and deepening the understanding of the material. Triangulation will be achieved by analyzing data from interviews, presentations, and arts. I analyzed the different types of data to determine and compare similarities and differences.

Combining with constant comparative analysis in the first phrase, triangulation in the third phrase helped me to validate the data.

Protection of Human Subjects

This study was conducted in compliance with the federal government's "Common Rule" for the protection of human subjects, and in accordance with research ethics. Human subject protections were utilized in order to protect the rights of the participants and the integrity of the research. Any and all documents belonging to the proposal for this study were submitted to the University's Institutional Review Board (IRB) strictly following the IRB Requirement Guide. The researcher also submitted the research instruments to the school districts and gained approvals from the school districts.

An parents' consent form (see Appendix C), an email invitation (see Appendix D), a child's consent letter (see Appendix E), and an informed consent form (see Appendix F) were provided to notify the participants and their parents. The consent letter contains a concise and focused presentation of the key information to help middle school and high school girls understand why they might or might not want to participate in the study. The consent letter contains:

1. Brief summary of research purposes;
2. Overview of research procedures, including number of visits are required and amount of hours total;
3. Briefly description of potentiation risks;
4. Summary of rights and freedoms of participants in the study;
5. Additional information or assistance needed for the study.

Every participant and their parents were required to read, understand and agree with the informed consent and sign it as proof of the above. To make sure the participants and their parents understand their roles and the purposes of the study, I thoroughly explained the process of the study through face-to-face or phone calls. During the data collection, I will respect participant's rights to decline or withdraw from the study. Participants have rights to refuse to answer some questions. In data analysis, I will keep participants' information and records confidential in order to protect participants. All information and record will be saved in researcher's personal computer with a password. Participants will use pseudonym to protect all participants.

Trustworthiness

In qualitative study, trustworthiness can be described as confidence in the methodology and findings of the study, and its applicability, consistency, neutrality and truth value (Krefting, 1991). Bias and reactivity are two threats that affect the validity of this proposed research (Maxwell, 2013). On the one hand, as showed by Maxwell, research bias is hard to avoid when gathering and interpreting data. The researcher in this proposed study has different mother language and cultural background than the participants that may cause misunderstandings of some answers and prevent the interactions between participants and the researcher. On the other hand, it is hard to eliminate the influences of the researcher and study settings on participants' answers (Maxwell, 2013). In this study, participants are middle school and high school students who might be influenced by others in art-based activities or felt stress about the interview environment.

As a research assistant in Girls in STEM program, I worked and did research with many participants in our program before. Over the past two years, I am familiar with most of my

interview participants. My perspective has also been shaped by interactions with middle school and high school girls. I can feel the motivation, passion, and enjoyment that students obtained from our program. I feel that they are influenced by our program when they discuss their experiences and potential careers interests. Thus, when analyzing the data, I tried my best to eliminate these positive feelings and personal bias. I also wrote up my self-reflection during each step of data analysis.

There are many techniques to assess trustworthiness and help improve quality and validity in qualitative research (Johnson & Christensen, 2004; Smith, Flowers, & Larkin, 2009; Maxwell, 2013). Multiple techniques were employed to assess the trustworthiness of this study: rich data, respondent validation (Maxwell, 2013), triangulation (Stake, 1995), and peer review. Firstly, the researcher collected rich data through conducting interviews, art-based activities, and memos. The sources of data included audio voice, text, and visual art. The intensive interview, as the main data collection method, collected detailed and varied enough data to present a whole rich picture (Maxwell, 2013). Secondly, the researcher asked participants' feedback about the data and conclusions. The researcher asked participants to provide feedback to verify the correctness of data interpretations. By doing so, the study reduces the chances of misinterpreting the meanings. Thirdly, the researcher applied Stake's (1995) data source and methodological triangulations. In this study, triangulation was conducted through collecting in two different data instruments and different times of interviews and follow-up interviews. To have a better interpretation, this study combined the data of interview and arts-based activities together to "increase the confidence of interpretation" (Stake, 1995, p. 114). Triangulation also provided information in the process of identifying emerging themes and later findings. Lastly, the researcher asked a group of peers to provide critical review feedback on data interpretations and

conclusions. Peer review was employed to help avoid potential bias and improve the credibility and validity of the study.

Researcher Positionality

As a researcher, it is essential for me to understand my lenses and how these lenses affect the interpretations of the data. I am an outsider to Latino and Hispanic cultures. Living in South Texas for five years, I have experienced some Hispanic cultures and traditions. But by reading the literatures and studying cultural dimensions from my PhD courses, I gained a better understanding of Hispanic and Latino cultures.

Furthermore, I am an insider of the single-case in this research. I worked as a graduate assistant in this program and focused on the evaluation of the STEM enrichment program for middle school and high school girls. I designed studies to explore the effects of science activities on students' STEM interest and gained prior knowledge about the case. Moreover, as a case researcher, my roles serve as a biographer and an interpreter (Stake, 1995). According to Stake, as a biographer, I would understand a phase of participants' life and explore what they have experienced within the boundary of the case. The biographer recognizes that participants' experiences may have their own patterns, uniqueness, or may hold in common with others' experiences. As an interpreter, I recognize problems and study them, hoping to interpret the findings better with other theories and knowledge (Stake, 1995). I, as a case interpreter, express new interpretation, point to what to believe, facilitate research for audiences to understand the case, and extend the body of the literature.

My professional background and experience was sufficient to understand the process of conducting the research, collecting data, and presenting the findings for this study. During the process of conducting each part in this study, I was always aware of my roles as both a case

researcher, an outsider of Hispanic culture, and an insider of Girls in STEM program. In order to ensure the validity and credibility of the study, I put attention on avoiding bias, getting close to participants, and understanding my research phenomenon. Special attention was paid to protect the participants' autonomy, privacy, and rights.

Conclusion

This qualitative study was guided by the three research questions with the purpose of exploring middle school and high school girls' learning experience of participating in a STEAM program and the influences of the program on their interests, self-efficacy, and career development. The methodology for this study used embedded case study approaches and was designed according to the purpose of the study (Stake, 1995; Yin, 2003). Girls in STEM program was introduced in the study and selected as the case study for its own uniqueness.

In-depth interviews and art-based activities were used as research instruments to understand the middle school and high school girls' experience, interests, self-efficacy, and career development. The study followed Stake (1995) and Yin's (1993) data analysis strategies and used constant-comparative (Corbin & Strauss, 2008; Dyson & Genishi, 2005; Merriman, 2001) methods to compare participants with different backgrounds and heavily relied on an understanding of themes and propositions presented in the study. The participants of this study consisted of 41 middle school and high school girls (grade 7th to 12th) who had long-term participation experience in the program, but only eight participants were selected to represent the study and present in embedded cases. Followed by the case study design, the researcher purposeful sought in-depth information from embedded "unit of analysis" which represents eight participants in the study (Yin, 2013, p. 23).

In order to support the accuracy of the study, the research was conducted with respect to professional research ethics and the protection of human subjects. The researcher was aware of her limitation and bias and paid special attention on protecting minors in the process of conducting the research. Also efforts were made to ensure the trustworthiness in interpreting and presenting the research conclusion and suggestions. Best practices were used to avoid any harms and risks in order to maximize the benefits of this study and help to improve its trustworthiness and generalizability.

Chapter 4: Presentation and Analysis of Data

STEM education is a pivotal issue in current educational development and reform. In line with the rapidly changing technological era, the United States places a great deal of effort into refining and promoting STEM education. The U.S. government, along with Congress, State legislatures, and school STEM programs, implemented extensive efforts to reform K–12 STEM education and cultivate the next generation of skilled scientists, engineers, technicians, and science and mathematics educators (Kennedy & Odell, 2014). All efforts make it clear that it is more important to prepare youth to bring knowledge and skills to problem solving, make sense of information in future careers, and know how to apply in real-life situations.

Research demonstrated that STEM OST programs increase students' interest in STEM content and career, STEM self-efficacy, school connectedness, self-identity, and excitement about STEM subjects (Leonard et al., 2016; Mann et al., 2015; Mohr-Schroeder et al., 2014; Yanowitz, 2016). Many STEM OST programs have a special focus on underrepresented minorities and girls at early age. However, despite many positive findings, prior research was limited in terms of methodological issues. Students' samples in the prior studies in South Texas have a limitation on Hispanic girls, which could be a research gap for understanding self-efficacy, interest, and early stage career development in STEM among underrepresented groups (Jimenez et al., 2018; Saw et al., 2019). The purpose of this qualitative study was to explore girls' learning experience of participating in a STEAM program in South Texas and the influences of the program on their interests, self-efficacy, and career development.

Three research questions were explored in the following part:

Q1: What are girls' experiences of participating in a STEM enrichment program?

Q2: How does the learning experiences of participating in a STEM enrichment program impact girls' self-efficacy, interests, and career choices?

Q3: To what extent does the learning experiences of participating in a STEM enrichment program impact girls' self-efficacy, interests and career choices, especially in STEM fields?

This chapter introduces the background information of participants, then, presents eight cases to explore participants' experiences of participating in Girls in STEM program and the influences of the program on their self-efficacy, vocational interests, and career choices. These eight participants were selected from a sample of 41 participants and presented the best cases to answer for each research question. A summary of each case has been covered in the last part.

Background of Participants: Similarities and Comparation

Eight girls who participated in the study had long-term participation experience in the program. This purposeful sample consisted of five middle school girls and three high school girls. Three of them participated in the Girls in STEM for three years, and the five remaining students involved for two years. During the data collection period, five of them accomplished art-based activities as well as interviews, and rest of the three students completed interviews and follow-up interviews.

These participants have some similarities in two aspects, motivation to participate in a STEM OST program, and the environments of study and living. One of the most common reasons for these eight participants came to Girls in STEM program was to acquire more about science and math when they were in the middle schools. They were motivated by their own interests or people around them, such as teachers and parents. In the process of participating in Girls in STEM program, they gained interest in learning STEM and expanded their knowledge about science and engineering, so they kept coming back and stayed active in the program. For

example, Clara did not know anything about programming, after three years' participation, she knew more about programming and was more interested in science. As she presented in her drawing, "I drew is a tree with branches sticking out. Huge branches sticking out to like symbolize how I grew up or like kind of grew and like expanded my knowledge and science and engineering here at the camp."

These eight participants were all studying in the CDISD and SISD and living in the south and downtown areas in South Texas. The basic information of these two school districts was provided in Chapter Three. Besides that, several participants expressed the challenges and issues in their school districts and communities, which prevented their advanced learning. These issues were mainly 1) unsupported school learning environments, 2) lacking resources to learn advanced STEM, and 3) stereotypes from students and people around them.

As for the school learning environment, Ariana expressed that the behaviors of some kids distracted her from learning in the school. The thing that made her upset was that the school did not do anything to exclude the negative effects or have the counseling sessions for those students. She questioned the school administrators during the interviews:

> Why keep on accepting the kids that do bad things in school? You should just have them eliminating, not eliminating, not kicked out, but just not go to Treviño [a middle school] no more. They can go to any other school, but yet they want to go back to that school. Even though they say, "oh, I don't like it here. I want to move, why go back? Well, then kicked out the kids who do not follow the rules.

Furthermore, Elisa mentioned the schools had many fights, she was trying not to get involved in any fights and attempted to avoid getting trampled by the crowd or getting pushed into the wall. She shared how she avoided the negative distractions in school:

> You need something that you can push them away with and those heavy books really help, which is another reason why I'm like super nerdy because I read a lot because I wanted to keep that with me so I could be like [pause] runaway.

As for acquiring resources, several middle school girls expressed that schools did not provide enough resources to learn the fields they were interested in, such as engineering, art design, and language. As a result, these lack of resources might prevent them from developing essential skills and applying the knowledge they gained from Girls in STEM to their school studies. For example, Clara, a high school girl, was interested in languages and liked to learn how accents work and how people talk. However, her high school did not provide a language course. So, she had to go back to her middle school Japanese teacher and learn Japanese from an online course which was made by her middle school teacher. She mentioned:

> I'm not as good as speaking it, but I'm better at reading and writing it because like, well I just took like online class, like I don't have anybody to talk to because it's online that I'm better at writing it and reading it and like listening.

It is important to note that most participating students in this study had no direct firsthand experience with learning programming, engineering, and other STEM concepts. The major channels for them to gain information are through their family, school classes, teachers, and Internet resources, such as YouTube and coding/programming software. Students' information about STEM before they participated in Girls in STEM was rare. During the interview, an incoming high schooler, Nora expressed that her high school did not have a robotics club, and she might not have had the opportunity to practice robots in her high school. Similarly, Ariana mentioned, "Because I haven't had like an engineering class this year, so I wouldn't know how I would have improved in engineering." Therefore, it is important to build the connections between school, family, student, and the OST program.

All the girls noticed people's stereotypes about participating in the STEM program and the challenges for females to pursue careers in STEM fields. As Arianna mentioned, some students around her were curious about the program, but girls had the stereotypes of participating

in the STEM program. For those girls who did not want to join, Ariana explained they might have misunderstandings, and that the program was another school where students spent the summer to learn all about technology and engineering. Whereas, the boys held different perspectives; that the program was fun, and learning programming was a cool thing. To eliminate the stereotypes, Ariana believed girls needed more clarity of what was the program is all about, "I'm pretty sure the girls are going to be like, oh, how did you do that? And then if we explain it to them how we did it, they would be more like intrigued by it." Additionally, although Felisa did have any specific career goals in her mind, being a scientist or an engineer could be a challenge for girls and even harder for women to reach higher positions in STEM-related fields. But, she wanted to create a goal and was looking for more opportunities and guidance.

Although participants have things in common, each case presented different aspects relating to the research questions. Elisa's case highlighted the two influential sources to construct self-efficacy and the differences between selected and imposed environments. Felisa's case demonstrated how the program provided more experiences and resources for Latinas interested in STEM. Amada's case presented how environmental and personal factors influenced the formation of a middle school girl's career interests and goals. Ariana's case presented her perspectives of Latino culture and explored the influences of environments on her personal and behavior factors. Nora's case offered her participation experience in Girls in STEM first, followed by how the STEM program helped develop Nora's career interests. Savanna presented a rich picture of her learning experience in Girls in STEM, along with the influences of her learning experience on developing self-efficacy and career pathway. In Clara's case, I combined her drawing from art-based activities to describe her long-term learning experience in the Girls in STEM program. Reya's case illustrated the impact of family as a collective environment on a

middle school girl's career development. The following section is demonstrating each case in detail.

Presentation of Eight Cases

Subsequent to collecting data through in-depth interviews and art-based activities, the eight cases have been presented in this part. According to Yin (2003), a person is the primary unit of analysis. The research questions decided the selection of the appropriate unite of analysis. These eight middle school and high school girls were the best cases to explore girls' learning experience of participating in a STEAM program and the influences of the program on their interests, self-efficacy, and career development. To present the cases, propositions were important and necessary to identify the relevant information about each individual. Thus, in the following part, I introduced each participant and explained the reasons of the sections first. Then, the two data collection instruments were combined to explore participants' self-efficacy, interests, career aspirations, and the influences of the program. Finally, I present how each case help me understand the research questions.

Case One: Elisa

Elisa, a 12-year-old Hispanic girl, was an incoming 7th grader when I interviewed her. She was studying in SISD and participated in two miniGirls summer camps in 2018 and 2019. In the summer of 2019, I conducted two interviews with Elisa and collected her drawing and presentation from one art-based activity. During the data collection process, Elisa shared a wide range of topics, offering her thoughts about the community and school, the learning experience, her interests, and goals. In this case, I discussed Elisa's imposed and selected environments first, providing her perspective of the surroundings and presenting her learning experience in Girls in STEM. Then, I explored the sources of Elisa's self-efficacy, highlighting the importance of

performance accomplishment and vicarious experience in constructing her self-efficacy. In the last part, I demonstrated the role of self-efficacy in developing Elisa's interests and building her career pathway.

Part one: Elisa' environments from SCT perspectives. In Bandura's model of triadic reciprocity, human behavior was influenced by internal personal factors, behavioral patterns, and environmental events (Bandura, 1989, 2001). As for environmental events, Bandura (2001) distinguished between three environments, namely the imposed, selected, and the constructed environment. The imposed environment dictates the boundaries and narrows the scope of human behavior (Bergman, Bergman, & Thatcher, 2019). Bandura (1999) stated the individual has little control over its presence in an imposed environment, but "they have leeway in how they construe it and react to it" (p. 6). However, the selected environment provides the largest scope of human behavior and therewith the broadest range of agentive space (Bergman et al., 2019). In a selected environment, individuals formulate appropriate action and decide how to behave. They can choose behaviors that best suit a desired outcome in a specific situation. Therefore, looking into Elisa's case, she was studying in a middle school in SISD, which reflected as an imposed environment. Whereas, she actively participated in Girls in STEM program and selected an environment for herself to achieve a desired outcome. The following part presented Elisa's perspectives of school environment and the learning experience in the OST STEM program.

Elisa' perspectives of school environment. In both Elisa's drawing and interviews, Elisa revealed her dissatisfaction with her surroundings. When she tended to answer the questions of "what is your life" in art-based activity, she became emotional and started to cry. The Figure 5 is Elisa's drawing of her life. In the picture, she used different colors to represent negative emotions, including sadness, anxiety, broken heart, anger, bullying and positive feelings such as

happiness, friends, and love. Furthermore, she presented more negative emotions than positive emotions by using more blue and red than pink and purple. For example, she used black for trust by saying “it's like a heart and it's like kind of broken because a lot of people are broken my trust over time.” She only used few lines in purple for happiness, but a lot of blue lines for sadness and a lot of red lines for anger.

Figure 5. Elisa’s life.

During interviews, Elisa described her school by saying “School is dramatic. School is ridiculous.” She mentioned two reasons that caused chaos and dissatisfaction. The first reason was the construction in her school area. As she described, her school was building an intermediate school and a new pre-k center, which separated students from fifth to eighth grade caused chaos nearby. These changes forced her to separate from other students and she lost her

bond with friends. As she said, “It’s kind of messed up. It's like you're losing all those bonds that you just got finished creating.”

The second reason were the fights in Elisa’s school. She described how serious the fights happened in her school were by saying, “one day it sucks. We had like eight fights, like five that the teachers knew about and then there was some more.” The different fights in her school made her more concerned and aware of her situations and surroundings. She was trying not to become involved in any fights and attempted to avoid getting trampled by the crowd or getting pushed into the wall. The ways she used to protect herself by pretend to be a nerd and keeping up an image of being nerdy, such as having the hair up, having a hoodie, and carrying heavy books. She mentioned:

> You need something that you can push them away with and those heavy books really help, which is another reason why I'm like super nerdy because I read a lot because I wanted to keep that with me so I could be like [pause] runaway.

Elisa’s experience of participating in Girls in STEM. As mentioned above, Elisa did not have time to see her friends during the school year because of how the students were grouped in her school. However, in both her interviews and drawing, Elisa expressed how making new friends and building stronger bonds with them became her best experience of participating in the Girls in STEM program. In the process of working on projects during her first summer, Elisa had chances to talk to different groups of people (e.g., teachers, camp counselors, and guest speakers) who she did not normally talk to in the school. She also worked with girls from different schools who had similar interests. After the two-week summer camp, she made new friends as they solved problems together, experiencing similar frustrations and successes. Similarly, in her painting, she used lots of smiley faces to represent several fun things in the program, such as singing, communication, and food. As she expressed:

> I got to talk to more people. I got to work on these projects with other people, which can build a kind of different bond than just talking to someone because you've experienced that stress together and you've experienced that, like that sadness or that worry together and you've gotten each other through it. So it's more of a stronger bond.

Figure 6. Elisa's drawing.

This part reflects the interdependent relationship between behavior and environments. Elisa presented different attitudes and behavioral patterns in two different environments. She presented more negative emotions in the imposed environment, while more positive attitudes were involved in the selected environment. She tended to avoid being recognized in her school, but actively engaged and communicated with people in the OST setting.

Part two: Sources of Elisa's self-efficacy. From SCT perspectives, self-efficacy was constructed through four sources, performance accomplishments, vicarious experience, verbal persuasion, and emotional arousal (Bandura, 1986). Performance accomplishments and vicarious

experience are two major influential sources in constructing Elisa's self-efficacy and are represented in the following part. According to Bandura (1999), successes raise mastery expectations, while failures lower them. People convince themselves that if others can do it, they should be able to achieve at least some improvement in performance (Bandura, 1986).

Through modeling and modeled behavior, the comparison is a strong intrinsic motivation for Elisa, and she appraised her abilities through social comparisons. On the one hand, Elisa revealed low perceived confidence in herself. As she mentioned, whenever people complimented her, she beat up on herself. For example, in responding to an interview questions about the sources of self-efficacy, Elisa said, "I hear people calling me smart and calling me pretty and stuff like that. I'll be like, thank you. I'll be like, you're wrong. But thank you. Because, I'll always be comparing myself to someone else." Similarly, in school, when she got lower scores or did not perform as well as others, she got confused and reflected on the reasons why. On the other hand, Elisa had higher confidences in herself when comparing herself with students who did not behave or got lower grades. During the school years, she always had a hectic schedule and focused on her study by avoiding the distractions from the surroundings. She was proud of going through all the challenges and getting all A's in her pre AP classes. As she mentioned, "I don't tend to struggle on tests or certain things. I'm more like, I'm going to go home. Might read a page or two, probably going to do all this homework first, see what happens."

Additionally, Elisa's perceived self-efficacy related to her performance and behaviors in Girls in STEM program. As she described, at the beginning of the camp, working with EV3 robot was a challenging task. Negative emotions and impacts occurred when problems repeatedly happened and when she compared with others by asking herself "Why I cannot do it? Why others can do it?" The negative attitudes became stronger when other people were getting it

right and she got it wrong. As a result, these negative experiences and attitudes directly affected her confidences in other robotic or programming related activities. When I asked about her perspectives of participating in a robotic competition, she expressed she might be messed up and failed in the competition. It was uncomfortable for her to compete with girls who had more experience and achieved better performance. As she mentioned:

> I'd probably mess up a lot and I probably wouldn't like that because it would be like so many different people and like I may feel bad because those people may have more experience and maybe much better than me and then I'll beat up on myself and that's not good.

Having more experiences and getting support from people in the camp helped Elisa reduced negative impacts and strengthened her self-motivated persistence in doing activities in the summer camp. In the process of learning, Elisa realized the difficult obstacles could be mastered by sustained effort. During the interview, she described how did the first year experience in the program helped her to solve problems and reduce stress in the second year. As she mentioned:

> When the competition starts and we're not doing so good because we're stuck on one of them. But it's okay because I think I've gotten farther than last time, to be very honest. But I mean, I've gotten like more calm about the robots and it felt easier this year when we were like putting together the threes and doing the coding the first time I was like, Hey, I remember some of this stuff like that. It was like, yeah, I know this stuff.

As a result, improvements in behavior transferred not only to similar situation but also other occasions. As described by Elisa,

> I think it's really fun and really rewarding because at the end of the day you're learning something under the situation. You're learning those problem solving skills. You're learning how to fix that problem. You're learning how to talk through it with other people, how to incorporate many ideas into one or how to incorporate what works.

As can be seen from Elisa's case, performance accomplishments and vicarious experience are two important sources of self-efficacy. These two sources interacted and affected Elisa' internal personal factors and behavioral patterns.

Part three: Forming interests and achieving goals. Self-efficacy, as the central mechanism of personal agency, played an important role in developing Elisa's vocational interests and goals. When Elisa answered the question about career interests, she indicated the impacts of self-efficacy and outcome expectation in forming interests and achieving goals. On the one hand, Elisa was interested in the fields where she had more capabilities. In the past two years, she shifted her interest from being a veterinarian to being a lawyer, and now she became interested in being a therapist. As she explained:

> I realized I'm not super good at arguing because I tend to get very emotional about it and start like crying or screaming or overreacting and I didn't want that to happen because that would be really bad in court, bad for like a client bad for me and I could end up helping someone that really doesn't deserve it.

On the other hand, Elisa expected to help more people. Her three career interests of veterinarian, lawyer, and therapist, had the common piece of helping others. As she mentioned:

> I know that sounds super cheesy cause it's like everyone wants to make the world a better place. But I could really help people because it can help so many people feel better about themselves and they can help give people the tools to make good decisions in life. And I focus on that because I really want to help other people because I'm very empathetic and I'm very focused on how my actions affect others.

To become a qualified therapist and to help more people, she was interested in learning psychology and sociology. As she mentioned, "knowing like psychology and sociology, I can learn the odds of like how highly it'll affect someone and if it'll even affect that person. Maybe I can be able to analyze people better and understand what they're going through better and understand my surroundings better." By learning related subjects, she would probably help herself calm, understand her surroundings better, and better analyze people in the future. When

asked about her future goals and plans, she expressed that she planned on keeping up her grades and might take extracurricular activities in school. She also mentioned that she wanted to obtain psychology or sociology college degrees with scholarship opportunities and keep close to home so she could still be in contact with her parents.

Summary. This case presented Elisa's environmental factors first, followed by exploring the sources of self-efficacy and the roles of self-efficacy in forming interests and developing Elisa's goals. Elisa has a challenging school setting that didn't support her growth and development and she expressed many negative feelings about school. But the camp offered her a way to experience a different context, which shifted her self-efficacy and provides a fun learning environment. Self-efficacy, as the central and most influential mechanism in personal agency affected how Elisa appraised her abilities, led the formation of interests, which also related to the ways she interacted with others and her goals for further activity exposure.

Case Two: Felisa

Felisa, a 14-year-old Hispanic girl, was studying in 8th grade in Tarallo Middle School, in CDISD. Over the past three years, she was an active member of miniRobots and participated three times in miniGirls summer camps. In Felisa's case, I presented her values from Latino cultural lens first, followed by her experiences in the STEM program, concluding with, how the learning experience affected Felisa's advanced education and career development. Felisa's case demonstrates the influence the camp has to provide more experiences and resources for Latinas interested in STEM.

Part one: Culture, family, and school. Hispanic culture is represented in different ways in Felisa's life. When asked questions about her perspectives of Latino culture, she stated Hispanic culture is related to the house, food, and things like candles. She also said, "Whenever I

get to walk into like my grandma, my aunt and uncle's house and my dad's house, I feel like if it's another home, which it is." As she described:

> Hispanic is from my dad's side. During any holiday, we celebrate it like the tamales or like some type of Mexican food or like some type of spice. We like to make a lot of food…we'd like to go out to Honduras and just visit family members and having Guadeloupe like a religion.

When we discussed Latina scientists or role models, she revealed she only knew a few of male Latino scientists. From her perspective, being a scientist or an engineer could be a challenge for girls, and women needed more motivation to reach higher positions in STEM-related fields. She shared the story about one Latino astronaut who went up into space by saying, "He had like a really good background for like a story and everything. He used to work in the field." Learning from his story, Felisa also wanted to inspire other girls to have the same goal or dream in the STEM fields. She expressed, "If I would grow up to be ordered or something big would inspire other little girls or something for them to like have the same goal or dream as what I think."

Growing up in a Hispanic family, Felisa highly valued the importance of family in her personal development. On the one hand, as the oldest one among the seven kids in her family, Felisa expressed her responsibility to take care of other kids. She was expected to be a role model for others and would think of anything that would help her family. When asked about future careers, she said, "Anything that will help my family, I would think of it. If everything that could help me and put me in a very good spot in the future or my family." On the other hand, getting family support is important for Felisa to achieve her goals. She mentioned her family encouraged her to become more involved in STEM-related activities,

> My family, they think like more girls or women should be should reach out to female scientist or engineer. They want me to become more things instead of like it being sexist or something. They are really supportive about it.

In school, Felisa had strong motivations to do the things that she was interested in and liked to look for opportunities which would be good for her future. She described herself by saying, “I don't like to follow the crowd of like other the kids and like to be like someone active email person. And like I, if I see an opportunity that's like good for a future or anything, I like to see.” Volleyball and basketball were her favorite sports, and she played well in her school. She described herself as an athletic person, because she liked all kinds of sports. As she mentioned, “I do like on my habits, like cheerleading or playing volleyball or basketball. I'm very active. And again, like I get hyper really fast.” As an incoming high school girl, Felisa did not have a clear idea of her high school life and did not know what she wanted in high school. She stated, “I like to think of what I want. I do not really know. I don't even know what I want.” In making her selection for high school, Felisa wanted to attended different recruiting presentations, picking a school she was interested in or a school which provided extracurricular activities.

This part revealed the culture, family, and school environments in Felisa’s life. Hispanic culture was an indispensable part of Felisa’s life, represented in different aspects of her life. The absence of Latino role models motivated Elisa to prove herself and inspire others. The family provided support for her development and influenced her interests and career aspirations, when schools did not provide enough resources for her to expose different fields.

Part two: Perspectives of Girls in STEM. Being in the program for three years, Felisa believed 1) the program is an active program who don't have enough resources or who are scared to get comfortable with other girls and 2) The program is a great way for women who want to get a higher education and involved in STEM fields in the future. Working with all the girls, Felisa expressed her goal that “I want to try go ahead of all the girls.” As she described:

> miniGirls is like a group of girls…Some girls have a lot more knowledge than men. Of course, they are awesome, we want to put in ideas and bench together…most girls want

> to be better than everyone else. They do not want to be a random person that they'd made things, that they want to have better ideas.

From Felisa's perspectives, Girls in STEM program provided a different learning environment than her school environment. The program presented "girls' minds and everyone can work together. If your idea is different, then figure out a way of how to change it and particular." Felisa demonstrated that the program was beneficial for all the girls to work out the problems and develop the necessary skills to get a better future. She stated:

> The program is a very beneficial tool, because it helps like all the girls to get together and even they get problems and they wanted to figure out the problems and they want to know if there is a way they can fix it and they love it. So they can give a better way of how to give the mindset and how we can get to be a better style, so that we can get back to advanced program.

When we talked about the all-girls learning environment, she mentioned that she enjoyed working with other girls because it was a great way to see other girls and other people's perspectives of different things. She felt more comfortable and more confident when working with girls because there was less tension than worked with smarter boys and were fewer negative opinions that other people put upon girls. As she expressed, "When girls and girls work together, they feel more comfortable because it's not that much weight than work with boys like they tend to be, made them, want to be smarter. We generally think that we're the best."

Part three: The influences of the program on providing sources. As mentioned above, Felisa's environments might not provide enough support for her personal development. The learning experience in Girls in STEM program provided support and resources in four aspects. As she stated, "it [the program] really helped me, open lots of doors for me" Felisa revealed that participating in the miniGirls program 1) could assist with her college application; 2) provided more knowledge on various engineering-related careers that could make more money; 3) spread

useful career information by inviting guest speakers from different industries; and 4) was beneficial for inspiring the people around her.

Looking into details, Felisa expressed the program was very beneficial for advanced education. She said that the program "is very beneficial for me. I say for like the future for college likewise anything that's like that can help me get in a good position for anything major or something that like." She also said, "what they teach us and I could also apply in the future. It's good for the application for college and also make more money in since it's engineering." Furthermore, the program was also beneficial for inspiring people around her, because she always shared what she did in the program with her younger siblings and other relatives. As she mentioned, the program inspired girls to look at different possibilities. As for her, she believed the program was good for her mindset. "I think it's a really, really good for my mindset of what it is and what it's teaching us."

During the interviews, Felisa demonstrated two components in the OST program, which expanded her knowledge. The first that the program provided opportunities for hands-on learning activities and collaboration. The activities and materials in the program awoke her interest in thinking of how technology could change people's life. She mentioned many technologies people used in real-life were not modern and effective enough. Whereas, the technologies presented in the program were modern and could make people's life more efficient. Thus, she liked comparing what she learned from the past experience and illustrated what else she could do with the computers in the future. As she said:

> The material that they gave us a really makes us surprise. Once they expressed how we feel about it. And that helps what we think and want to bring it into the computer or on paper and just our hands go free and started writing or grading material.

The second component was the interaction with people from different fields. Adults from different fields played an important role in broadening her thoughts. As I explained above, she did not have any specific career goals in her mind, but she kept looking for different possibilities. The guest speakers in the program motivated her and pushed her to have higher future expectations. As she said, “I would see myself in their positions or if I want to see myself on their positions. and I want to make like a goal or something of what I want to do when I get older.”

Summary. The case introduced Felisa’s school, culture, and family first, then highlighted her perspectives of the Girls in STEM program and demonstrated how the program had provided more sources for underrepresented Hispanic students. Hispanic culture presented in different parts in Felisa’s social life. A part of her social factor, her family had great a influence on her personal development and she wanted to take care of others, got family support, and approve herself to her family. Her personal motivating factors, such as doing things that she was interested in and looking for good opportunities, also related to her perspectives of the program and was represented in educational choices she made. From her participation experiences, the activities and materials in the program arose her interest in thinking about how technology could change people’s lives, and the guest speakers in the program motivated her and pushed her to have higher future expectations.

Case Three: Amada

Amada is 12-year-old Hispanic girl, studying in a middle school in the SISD. She participated in Girls in STEM program during the period of the summer 2018 and summer 2019. I mainly used Amada to present how environmental and personal factors influenced the formation of a middle school girl’s career interests and goals. The environmental factors in this

case, included family and learning experience in STEM OST program, while the personal factors focused on the Amada's intrinsic interests. These two factors interacted one with another, impacting Amada's interests and goals. Additional information about challenges for women in pursuing STEM is also explored in this case.

Part one: Learning experience in Girls in STEM. From Amada's perspective, Girls in STEM program provided an opportunity for all girls to do hands-on things that they never really did before. She enjoyed working with all the girls in the program. As she expressed, "the first letter G of the program is really for girls and it's not guys or anything. It's miniGirls, which means that it's only for girls."

When talked about her experience in the summer camps, in both interviews and drawing (Figure 7), Amada expressed teamwork and communication, were two important components for every girl in every activity. During the summer, she generated new ideas and learned from others by working in the team. In the process, if she faced any problems, team members gave her more ideas, which she had never thought before. If her team faced any issues while finishing the tasks, they figured out as a team how and what didn't work. Then, they thought about what they could do to improve it. For example, she described how her team worked together and successfully improved the solution in a bridge building activity.

> In the straws in the wood activity, she [a teammate] didn't really teach me but she made idea of cutting the straws in half and they just liked using the tape on like the bottom of the straw. So you can hold it as a table or something 'cause you're trying to make the bridge out of it. And they can be stable to put like another layer and just like tip that around when you think that's a good idea. That actually works for me. Went to 1,000 to 500 pounds that it could way.

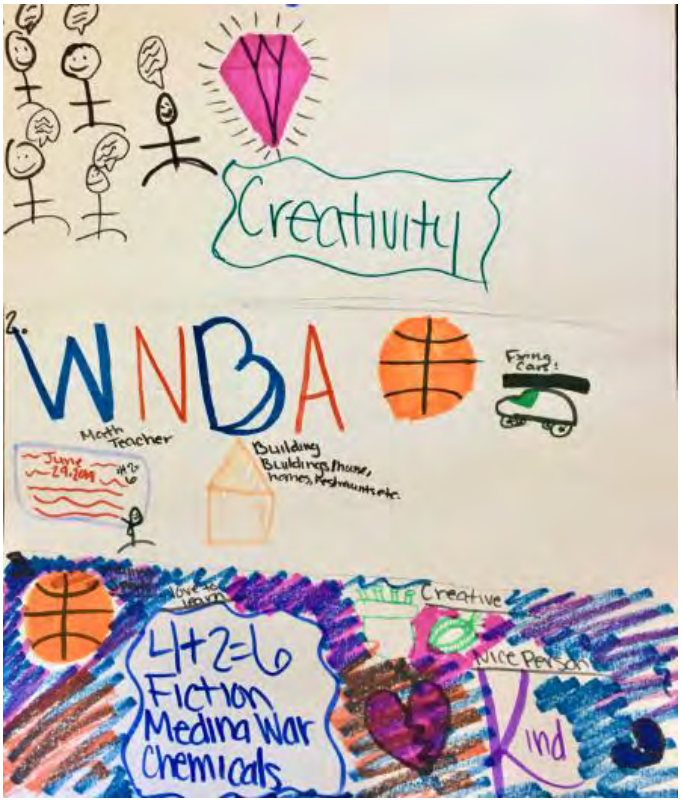

Figure 7. Amada's drawing.

Part two: Forming career interests. During the interviews, Amada shared information about her family and talked mainly about what she was interested in. She revealed that she was interested in being a basketball player, a teacher, and a mechanical engineer. As she mentioned, "I don't really have like a career idea, but like I'm depending on inner to being like WNBA or like to be like a teacher. It's either one of those and stuff." Those career interests were mainly influenced by her intrinsic interests and family members.

First of all, playing basketball is Amada's personal interest. As she mentioned, "what am I dream job is to become a basketball player for WNBA. My favorite team is either the Spurs, the Toronto Raptors, one of those." In her school, she was a current basketball player in the junior team and intended to play for high school later. When talking about the capabilities of shooting,

Amada was confident and shared how her family pushed her to a higher standard. As she mentioned:

> My family push me to a higher standard whenever I was playing basketball when I was younger. I was so trying so hard, like how to make 3-pointers. ‘cause I couldn't, because I was too short. My dad, he just pushed me saying you can do it no matter what, just don't have this fear of never doing it, cause one day you will do it. Like two years later, I actually made three points and all that. Same thing with three points. I was doing the last year and then by the season was over, the first game or the last game I made it three points in the team's tournament.

The second career interest was influenced by her mom. In Amada’s family, there are four kids, an older sister, a younger sister, and a younger brother. Her mom did not really have a job because she needed to take care of the younger brother. But recently, her mom was thinking about being a substitute teacher for kindergarten and pre-school. Getting influenced by her mom, Amada had the expectation to be a person who could take care of other children. As she said, “I am influencing by my mom, being a good mother and a good cooker and all of that for taking care her children and all that.” From her perspective, teachers had lots of work and needed to spend a lot of effort taking care of students, but they could get as much as appreciation from others. When asked about what kind of teacher she wanted to be, she expressed, “I just figured that if I become a teacher then I can kind of change that just for like being strict, not really strict, but like a good teacher by the same time, not a bad teacher.”

The interest in being a mechanical engineer was influenced by her father, as he was working in the car related fields and building his way into carpentry. She described her father’s work by saying:

> My father used to work for the oil fields and whenever like chucks breakdown or something, he would always go and help them out. When he was like 16, he had a job, car washing and then he built his way up into carpentry, which is building buildings and all. And then as he went older, he just wanted to set company and he still does.

Through learning from her father's experience, Amada gained interests in fixing cars as a mechanical engineer. When asked about what a mechanical engineer was, she expressed that the job for a mechanical engineer was to test out mechanicals, which was similar as fixing car. Although the definition of mechanical engineer may not be accurate, she was also interested in learning car parts and was curious about how each part works and its functionality.

The learning experience in Girls in STEM helped develop Amada's interests in being an mechanical engineer. Specially, activities such as building EV3 robots and programming robots could have real-life applications to her future work. When asked about how summer camp applies to life, Amada mentioned:

> miniGirls helped me with it [fixing car or building buildings], because like building within EV3, there's so many different parts that connects to an EV3, how it moves. So technically like Legos and all that. It's basically like branches and hammers and screwdrivers and all that. But like instead of an EV3, it's a car. So it's basically like the same thing just with like different tools.

The experience of working on EV3 robots could be helpful for her to build things and understand each part of the car. It also helped her understand the concepts of engineering and being a mechanical engineering in the future.

Part three: Challenges for women in STEM fields. During the interviews, Amada revealed two challenges for girls or women to work in the car fixing industry. The first challenge she realized was the female-male ratio, which might cause gender bias in the car fixing industry. As she mentioned, "I've been noticing every time I go, if like a tires flat or something, my mom would go to Pleasanton cause that's usually where we're at that time…it's always boys and guys and everybody, except for girls." Facing the unbalance ratio, Amada said she wanted to prove guys that girls were equally talented as guys and they were able to do stuff the same as guys, even though it might be a hard thing. As she said:

> I just kind of influenced myself to like, probably if I'm older I can probably get a job that works with cars or something. So that can probably be like, a girl doing one and they can or if I can prove myself to them saying that girls are much as better as guys are too and girls can do stuff the same as guys.

The second challenge she noticed was the stereotypes in a male-dominant industry. As she said:

> I think people do think that I'm going to be strange or something, cause I'm like working with all these guys. I'm the only girl there only because they might think their point of view. It's basically saying that guys are like showing that guys are much like powerful and stronger than girls are even though they both have the same commitments.

Facing these two challenges, Amada kept optimistic attitude and she said, “I'm not really thinking negatives, I'm thinking more positives than I am of negatives.”

At this point, Amada expressed that Girls in STEM program was helpful to provide girls chances to do different hands-on practices, probably proving girls could do STEM things as boys. As she said:

> I am very excited about the camp because it has lots of girls basically. It's really good that they started doing an all-girls camp because um, they just want to get girls a chance to do something that they never really done before.

Summary. Amada’s case demonstrated the development of a middle school girl’s career interests which were related to her intrinsic interests, family influences, and the learning experience in the STEM program. Family members contributed to Amada impression about certain positions or careers and presented to her real life cases in different fields. Her intrinsic interests motivated her to become active and learn more about each field. Activities in the STEM program, such as building robots and programming, had real-life applications and actually linked to her interests and career aspirations. In the process of achieving goals, getting support from family, teachers, and friends was necessary which may help her overcome certain challenges. However, as Amada noticed, working in a male-dominate industry she would have to face

environmental and social barriers, including stereotypes and gender bias. These challenges may affect Amada's interests and persistence in the future. Thus, it is important to create more supportive environments for women in STEM fields.

Case Four: Ariana

This case is another example to gives a better understanding of how Girls in STEM program provided more experiences and resources for Latinas, increasing a middle school girl's self-efficacy and developing her interests in STEM. Ariana started participating in the Girls in STEM between 2018 and 2019 where she also represented her school in miniRobots club competing in the First Lego League Competition. During March to April, 2019, Ariana as the first interviewee in this study actively engaged in three interviews, offering her thoughts of culture, school, OST learning experience, interests, career aspirations, and goals. From Ariana's case, I present the environmental factors, offering her perspectives of Latino culture and exploring the influences of supportive and unsupportive environments on her personal and behavior factors. Then, I demonstrate how she got support from an OST STEM program to develop self-efficacy and interests. Finally, I discuss the issues of Latina in STEM from a middle school girl' perspectives.

Part one: Ariana's perspectives of culture, community, and school. Raised in a typical Hispanic family, Hispanic culture was present into different aspects of Ariana's life and presented in different generations in her family. As she described:

> It is the way my parents raised me. Like the dance I've done, my mom, like grandma. My mom had me sorting beans…you put them on the table and pick them out. Like you separate the good ones from the bad ones. So my mom has me doing like when we were making beans. It just kind of like, whoa [awful voice].

She also described how her family prepared the Mexican festivals, "Sometimes we celebrate festivals, my momma probably cook or my grandma. We do those little barbecues. My

grandma, not my mom's mom, but my mom's mom, she came from Mexico, like straight out of Mexico." When talked about culture differences, Ariana said she was open to all different cultures, like Chinese, Japanese, and Indian. In her school, there was a high ratio of Hispanic students, but she treated them equally. As she expressed, "Like the white people, there's only like three or two and black people are like. They're not considered African American no more. They are like 2% because there's only literally two. We treat everyone the same cause they're all people."

Furthermore, during the interviews, Ariana expressed her perspective of the area she lived in now and the school she was studying. She revealed her dissatisfaction with people's opinions about her surroundings and school. However, from her opinions, people's discriminating words were annoying and confusing. She and her mom expected to change the situations by proving the area and school were not that bad.

When we talked about the area she lived in, she used a low and disappointed voice, as she thought for a while and had few short pauses in the conversation. She expressed her perspectives of her surrounding and how people judged them by saying:

> I like this area. It's the place where I grow up. Um [pause], but I don't like, I liked the area but I don't like, uh, [pause], I like what it feels like, but I don't like the area. [pause] Like it's not super bad, but like you always hear people saying like, Oh, you live in the west side, that's bad. Like it has a bad area. [pause] I just wouldn't want to hear like, oh, I live in the west side, I'm from the west side. Because they're like, oh, you, you grew up, you grew up from the streets. And I was just kinda of like, no [low voice].

Then, she explained the meaning of living on the street by using a lower voice. She stated:

> We basically don't pay for our stuffs. Basically we're living in someone else's property so we don't have really, then they say, oh you're living on the streets. That means like you don't have really a place to stay, because at any time they can just kick you out, anytime they want. [long pause] Renting an apartment is a little different because um, ours is like government assistance. Like the [inaudible] helps us. It's for like low income. So it's a

> little different. Cause in an apartment you pay like $500 to $800, which is a little more than what we pay. So when they're like, oh you live in the streets, it's like you basically have nowhere to live.

In addition, Ariana was not only hearing negative things about the area, but also knew of people's discriminating words about her school. As she said, "My mom's friend had thought about Treviño is a poor school. So when my mom told her about what we're doing, she was like, Oh, I thought the school was poor. My mom was like, she was shocked. I was kind of shocked too, like wow." After hearing all these negative thoughts, most of the time, Ariana explained to others that, "It's not about the area, not the school look poor or ugly or any other discriminating words. It's about the kids who go there and how they act." She mentioned some students in her school did not follow the rules and behaved in bad ways. These students, who might be considered as at-risk or lower performing, distracted Ariana's study at school. As she described, "Last year I had a lot of them are in my classes…My last year I was kind of like thrown in with them." However, the thing made her disappointed was the school did not do anything to mitigate the negative effects and offered any the counseling sessions to those "bad" students. As she said:

> I think they [school administrators] should do next year is they should start, which I know is going to suck. But um, why keep on accepting the kids that do bad things in school. You should just have them eliminating, not eliminating, not kicked out, but just not go to Treviño no more. You 're [school administrators] just sitting there, freaking, the best administrator. Like, come on, you want to do something to improve your school, kick out all the bad kids. How many of them? In my lunch period, I have like freaking 10 of them. But like that's schools, you said anything to do stuff about it, but they don't. So it's kind of like they didn't take action and what they said they were going to do.

In this part, Ariana presented her cultural values and perspectives of her environments. As can be seen, she was dissatisfied with the environment, and was expecting to change the situation through her efforts and school improvements. However, Ariana expressed that the school should put more effort into eliminating the numbers of at-risk or lower-performing students and mitigating any negative effects from them.

Part two: Learning experience in Girls in STEM. Ariana was interested in science and math and had always been good at science and math in her school. She liked doing hands-on activities and science experience, such as making bath bombs with her mom at home. The intrinsic interests and the encouragements from her teachers and parents motivated her to join in the STEM OST program and continue learning more STEM in the process of participating in the program. For example, she expressed her disappointment that there was no meeting in miniRobots in Spring 2019 by saying, "I thought they were, but they said it's only for one semester I think. And I was kind of mad."

From Ariana's perspective, miniGirls summer camp is "like a science and math based club where we do different projects and it's, it's fun. We have to be creative and think outside the box of like that." From Ariana's perceptive, Girls in STEM program was much more than a two-week camp. The program was a learning process to learn robotics and make robots to do things; it was more creative and provided her the opportunity to think outside of the box; and it was more fun than the normal classroom.

Ariana expressed that getting support and assistance from people in the program was important, and helped her understand the concepts and perform better in activities. Most of time, camp counselors and teachers in the program were helpful to solve her problems. But, sometimes the activities were lacking this assistance, which confused her. For example, she expressed her desire to participate in one robotic activity, where she needed to program the EV3 robot and to finish certain tasks in a certain time. She said:

> I kind of didn't like that [one robotic activity]. I didn't like that. It wasn't very, [pause], I do not know, it wasn't very interesting. They let us play with it for a while, but they were kind of just like, oh, you do this, you do that. I kind of want to, uh, what is it? Like they gave me something and I just like, I have a base to work with and then I do everything. Like I come up with it myself, not like you don't like me scripts of what you've already

> tried doing. That's what I didn't like that. They're like, okay, you have these lines you can't pass through, so how would you do it? I'm just kinda like, I don't know.

Influences on self-efficacy and career development. In the process of learning, Ariana developed her STEM identity through building a sense of belonging to the STEM learning environment. From the perspective of social identity theory, when an individual perceives greater similarities with in-group rather than out-group members, it is likely to see the stronger connection with in-group members (Tajfel, 1982). STEM identity as a type of social identity (who I am as a group member) relates to how individuals see themselves, how they view a sense of fitting in STEM, and how they recognize themselves as a group member in STEM fields (Kim, Sinatra, & Seyranian, 2018). In Ariana's case, she expressed she was proud of being a member of the program because it was an excited thing to share her experience and got a sense of appreciation for her family members As she described, "When my mom talks about it [Girls in STEM] to my family members, I feel like, yes, I know this program. Because they end up like, whoa, what did you do? And then I explain to what I do and then they're like, oh my God, you're really smart." According to Guan and So (2016), the development of STEM identity in Arianna's case reflected perceived social support from the environment, which also had positively relationship with Ariana's self-efficacy and behaviors.

When we talked about how the learning experience helped her study, Ariana revealed that participating in the STEM program helped her math and boost her confidences in math and science. Based on Bandura's SCT, the participation experience provided Ariana the most authentic evidence of STEM capabilities (Bandura, 1997, p. 80). As she demonstrated, she felt more confident in numbers because of the program. "I feel like if I just stay in the program, I will be more like, I'll get better at math and science." After finished two summers in the program, Ariana also gave herself a higher standard and expected herself to do better in the incoming

competition and summer camp. She wanted to learn a lot of things in the summer and achieve higher scores in math in the next semester. She said:

> This summer, I would do better and understand like everything, which is, there's not really much to understand except for that. I expect for next year for me to have 110 in math and 110 in science. Because this year already had 110 in math and 105 and just a little science.

When we talked about her career aspirations, Ariana expressed she wanted to be a dermatologist because she realized many people struggled finding right skincare for them. However, after participating in the STEM program, she opened more career choices and realized she could work in engineering and technology fields or become a coder in the future. As she mentioned, she expected to find a way for people who had different skin conditions by helping them in creating new things like medicine. Learning from a Youtuber and testing skincare products with her mom helped her understand different types of skins and the functions of various products. She expressed:

> I feel like if I had not going to be able to be a dermatologist. I will probably be like a something that has to do with engineering or something that has to do with like coding. I'll probably worked for NASA or something. NASA has some technologies, probably will be an astronaut, but I would want to be the person that's doing calculated everything.

Part three: Latinas in STEM. When asked about what was the challenges for her to achieve goals, Ariana kept a positive attitude by saying,

> “Probably, maybe, I do not know, cause nothing's stopping me right now. Like have good grades in science. Well, I don't have further, like I, we don't want to have any further problems when I do want to become a dermatologist. So I wouldn't say there's nothing stopping me, but eventually there is going to be something. I don't know.”

During the interviews, she revealed two challenges for her to pursue STEM. Even though money was not the first important factor when she made career choices, but financial problem caused some limitations for her to achieve goals. In case of the financial issues, Ariana might have difficulty to go to her favorite STEM-based charter high school, because of her family did

not have a car. She had to choose a high school nearby her home. As she mentioned, “that high school has science based stuffs. Since we don't have a car, I felt like I would probably have ended up taking the bus over there, but if I don't, I'll probably end up having to go to like [another high school] which they do have an engineering class.”

Furthermore, scholarship was one of her major concerns when she chooses a college. She preferred to attend the program which could provide financial assistance. As she mentioned, working for NASA was one of her options because NASA could pay for full scholarship for everything. As she mentioned:

> I wanted to work for NASA and they said that they would like that they pay for your full scholarship for everything. So I was like, well, if I don't think I'm a doctor, I'll become a worker for NASA.

Summary. In this case, Ariana shared what were people’s judgements on her environments, including her living area, social status, and school. Although she did not agree those opinions, she expressed her expectations to change the situations. Participating in Girls in STEM created a favorable STEM learning environment for her, but she expected more assistances during the activities. In the program, she got more experiences, practiced essential skills, and exposed different subjects. As a result of learning, she boosted her self-efficacy and got more information about other STEM-related fields. However, the social economic issues influenced her behaviors and actions, which may affect the persistence in pursuing STEM.

Case Five: Nora

Nora has been in the miniGirls summer camp and in the miniGirls club for three years. When I interviewed her, she was an incoming high schooler (9th grade), participating in the megaGirls summer camp. Facing the new high school life, she expressed her excitement and anxiety towards entering high school. She expected to accomplish more goals and achieve higher

standards. While, she felt stressful about being left behind others. In Nora's case, I presented her participation experience in miniGirls and megaGirls first, then I illustrated the development of Nora's interests. In the last part, I explored how did the STEM program help develop Nora's career interests.

Part one: Development of Nora's interests. During the middle school years, Nora was encouraged by her family members, actively participating in various activities and after-school programs, such as theater arts, band, football, soccer, and the STEM club. It was always her mindset of not saying no to anything that you are interested in. She also wanted to tell other girls that "Even if you don't know what engineering is or whatever, like give it a try or something like, or if you're going to go for sports, don't stop, have a backup plan, just keep going." Participating in different activities helped Nora recognize what she was really interested in. She expressed soccer and football were cool, but they were hard to play. Due to the unfair treatment she got from the coach, she gave up the sport teams. While, playing threat arts were frustrated for her because it was hard to remember the lines. Some girls and boys in the play were annoying. So, she decided to quit after the second play. She also tried band in her school, but she quitted after she felt it was too easy and not all of the band members were putting efforts collaboratively.

Although she expressed high interests in learning STEM, her interests were changing during her development. As she mentioned, she wanted to keep options open and STEM was a backup for her. The word "backup" was learned from a sport coach as she often told students to make a backup plan what if they got injured one day. Thus, Nora found a new interest in civil rights this year. As she expressed:

> I've found a new interest in like, um, and like civil rights and all that. I started to think about that this year and so it's got me more interested in now. Um, but I, um, I came here to like, have this as like a backup. So if I don't, like, if I don't end up doing that, I just, I can choose engineering.

Part two: Learning experience in miniGirls and megaGirls program. Nora stated participating in Girls in STEM program was a good experience for her and not every girl had such opportunity. Similar as Ariana, Nora also mentioned she was proud of being a member in the program. In the process of participating in the program, Noro also developed a sense of belonging and increased her confidences in doing STEM. From her perspectives, participating in Girls in STEM was a great thing and she enjoyed to share her experience with others. She said:

> It's pretty cool. Like, um, I think that a college basically doing. This is like something to be like proud of and the fact that I get to join this…Everyone tells me like this is like a good opportunity. Like we didn't have this back then…it makes me feel good that I have this now and that I can like use it. It's pretty cool.

Besides that, as she mentioned, she liked to be recognized and admired by students, teachers, and administrators in her school. For example, she described her experience of being recognized by people. She stated:

> We also wear pink shirts on Thursdays and Fridays for spirit days. So it was kind of cool cause everyone like kind of admired us. Like the teachers. I was like, Oh, you're in miniGirls. And then the principal, he started getting more into it. He's already knowing who, like who were the people that were in miniGirls.

Being in the program for three years, she made new friends, got help from others, and also offered help to others, which in turn, making her more open to others and increasing her confidence in communicating with others. She described her personal growth and how she made new friends in the process of participating in the program by saying:

> The first year I didn't want to be like around people. I was scared or something. And then other year I've been coming, I think, um, the fact that I'm around all these other people. Last year we had another school and like we made it, um, friends. This girl named Sama, I still talk to her. Right now, we're making new friends, like the people in our groups. So it makes me feel I can actually talk because in the first year I had a group and I didn't know what to do, cause I don't know how to code. They were like eighth graders that were doing all their work and they wouldn't let me. And so now even if I'm doing all the coding or something. I try to get them [coding] to the people in my group to code with me or help me or like me.

In Nora's case, the positive experience of talking to people gave her confidence that she could communicate well with people, even though they were from different schools. In the third year, she worked closely with her partners and tried to get others in her group to code together.

During the interviews, Nora revealed the presentations made from different people (e.g., guest speakers, visitors, and camp counselors) in the program broaden her minds in learning STEM concepts. Adults from different fields also opened her career aspirations by talking about different fields and giving gifts. As she demonstrated, the presentations provided the information she never looked into and gave her bigger ideas in a fun way. For example, Nora mentioned one of her positive experience in megaGEMS. On day in the camp, a group of visitors from a local supermarket came to the camp and gave a bag of gift to each girl. Nora was surprised and felt happy about it, because the thing she got was good for camping. She described her feeling by saying:

> I was like surprised when visitors came. I thought they were going to give us like you can do this for this, but they gave us something different. This is like something really different. So it kind of made my mood like Brighton, cause I was kind of bored at first. And then like, it kind of just like made me like more like happier. For some reason they gave us like makeup wipes, body lotion, lipsticks, lip lumps. Um, they gave us, um, dry shampoo. So all these like products for your like driving here.

However, she shared different perspectives of megaGirls summer camp during the interviews. As a rising 9th grader, Nora joined the high school summer camp in the summer 2019, where she mentioned she was separating from other friends who were still in the miniGirls summer camp. She said:

> I was sad. They took all the kids upstairs and it was all fun and like joy. I'm not saying that, um, [the high school program] is horrible. It's kind of just like quiet. Like it's not like upstairs, like everyone's screaming of joy and all of that. Here is more quiet. It's great, but it feels calming.

The separations between friends made Nora feel sad and lonely. It might be hard for her to make new friends in the camp. As she mentioned, “Laura (another camper in megaGirls) was telling me that last year we did have, we know more people than now. Like now it's just Laura and me that I know, but she's not here anymore. She's not going to do it.”

Part three: Perspectives of women in STEM. In the process of learning, Nora mentioned an activity which had positive influences on understanding women in STEM. During the summer, a guest speaker guided all girls to make posters for famous women in STEM fields. These famous women included a scientist superstar Katie Bowman and first female African American astronaut Guion Bluford. Learning from their stories, Nora changed her idea and expressed girls also have power to make the world different. As she mentioned:

> She [the guest speaker] told us like, see all these women made it. So you guys can do it too. Like you guys can change the world. US women can do it. Like our group right here can all do it. So it made us like more positive.

Additionally, the experiences of participating in Girls in STEM gave Nora a deeper understanding of women in STEM, which she barely gained from her school. She revealed her perspectives of women scientists before and after the program. As she said:

> When I think of science all the time, it's always like, I think of a man for some reason. When I come here [Girls in STEM program], it's like all these people are women and like they're engineers and there's some men, but they're like, I mostly see women here and it's kinda different. Because since I was a little girl I always thought like scientists, like it's always pops up like a man with like a white coat or something. I don't know why.

Then, she made an comparison between what she learned from school and the information she gained from the OST program. As she expressed, it was great that world was changing in thinking about how woman and their involvement in different professions has become quite normal. She said:

> For middle school and it kinda just made us think of all the cultural things different in the world. Like pink is like made for girls, and blue is made for boys. Like how it all started.

> Like skirts, how men used to use it and women used to took it away from men, like heels too. So now it just like kind of like made my mind flow. like I just see it as normal now as a scientist, as a woman. I think it's something to be proud of like the world, how it's changing now.

Thus, in Nora's case, studying in a selected and constructed STEM environment, her behaviors and personal factors has been affected. As a result, she became more open to different subject in STEM and was more aware of women in STEM.

Summary. In Nora's case, we could find evidence of how a high school girl formed her interests. Nora's interests were mainly influenced by people's appreciation, intrinsic motivation, and the challenges of the tasks. Depended on the different exposures and learning experience she gained, she kept changing her interests. Whereas, Girls in STEM program, as one of the programs she participated, had certain influences on the development of her STEM identity, which might increase a sense of belonging in STEM fields. As Nora stated, she made new friends, got help from others, and also offered help to others, which in turn, making her more open to others and increasing her confidence in communicating with others. The presentations made from different people (e.g., guest speakers, visitors, and camp counselors) in the program broaden her minds in learning STEM concepts and making her career options keep open.

Case Six: Savanna

Savanna started participating in the STEM summer camps since 2016. She participated twice in a two-week STEM summer camp and one six-week research camp. Now, she is in 11th grade in public high school in the CDISD, South Texas. As one of the longest participants in Girls in STEM program, her experience and perspectives were important to answer research questions, offering more interpretations about the development and the influences of the program on a high school girl. Similar as other cases, Savanna presented a rich picture of her learning experience in Girls in STEM, along with the influences of her learning experience on developing

self-efficacy and career pathway. Besides that, Savanna's case explored the important roles of adults on developing girls' expectations and goals. In the following part, I started to present Savanna's learning experience first, followed by the discussion about the influences of the program on her self-efficacy. In the last, I explored Savanna 's desires to break the stigma between gender.

Part one: Learning experience in Girls in STEM program. Savanna expressed there were not many programs like Girls in STEM program, which mainly focuses on providing opportunity for young women. She said:

> Whenever I tell people that I'm in this program, they seem to be like really amazed because there's not a whole lot of programs that allow kids to experience this, especially young women. That's something that I'm working on. I keep coming back to. I like it. I enjoy coming back.

As one of the longest participates in Girls in STEM program, Savanna 's experience provided a rich picture of program development. As she expressed, the program was growing fast and the curriculum was getting more diverse to different subjects. She mentioned:

> When I came the first time, it was still in the beginning of miniGirls. We didn't do a whole lot of programming. The curriculum is like more, um, I don't know, like it's kind of perfected now. We didn't have nutrition and we didn't have the nutrition program the first summer I came, we always ate out. They [administrators in the program] would always bring people to or something catered. And I think it's helpful to have the nutrition part involved. Cause I mean it's, it's helpful to have different types of sciences. Um, not only just engineering.

Similar as other girls in this study, adults played an important role in Savanna 's learning, extending her thinking and developing essential skills. As she expressed, when studies in an OST setting, especially in a university-based environment, it would be useful for her to get more assistance and learn from people who had a long working experience. Looking deeper into Savanna 's case, she mentioned how people helped her in the program by using Tommy and Josephine as examples. Tommy, a camp counselor and an undergraduate student in engineering

major, had been working with drones for a long time. Tommy and Josephine provided assistances and expanded Savanna ’s thinking. As Savanna expressed:

> I would understand it better than if somebody, like Tommy, like someone else, who, um, outside of the program were to explain it to me. And I feel like I can take that back to my school and to be able to explain those things to other people.

Another camp counselor was Josephine who increased Savanna ’s interests in doing their research project. At the beginning of doing research, Savanna and her team had no ideas about what they were going to do with their project. Josephine came and gave them ideas about how robots and drones are used to disable bombs. Savanna mentioned the conversation between she and Josephine:

> Josephine kind of helped us out. I asked her [Josephine] what about EODs? She said, what if you guys looked into that and see what there is with that. We’re [Savanna and her team member] like, what is that? And she said, well, that's how they get rid of bombs. And we're like, oh, that sounds like something interesting, like that we might want to explore. So we got into that project.

When it came to Savanna ’s experience in Girls in STEM, she drew her and her friends Kira, along with EV3 robot, programming, the program logo, and emojis. As we can see from the figure 8, the drawing presented several important components related to her experience in the program.

However, looking into details of her drawing, Savanna drew a sad face and used an arrow to point a happy face. The data from interviews provided more information and helped explain the meaning behind this transformation, As Savanna mentioned in her interviews, her attitudes change toward STEM has been changed in the process of participating in the OST STEM program. As she mentioned, in the first summer, it was one of her high school teachers who shared the information and invited her to come. At that time, she did not want to come, because

she was not interested to be an engineer. But now, she felt the program was more interesting and she enjoyed more than at the beginning. She said:

> When I came in, I was convinced that I wasn't going to be an engineer, and I didn't want to have anything to do with engineering. And I really didn't think I was going to enjoy the program. But at the end, even though that's not something I may want to pursue, it's still interesting to learn about it and to be able to explore things…I like doing programming. I think that's really something that's, um, interesting. I've grown to be able to be more accepting of new experiences.

As can be seen from Savanna ’s case, in the process of learning, she became more open to different fields and more accepting of new experience in STEM, especially in the fields of engineering and programming.

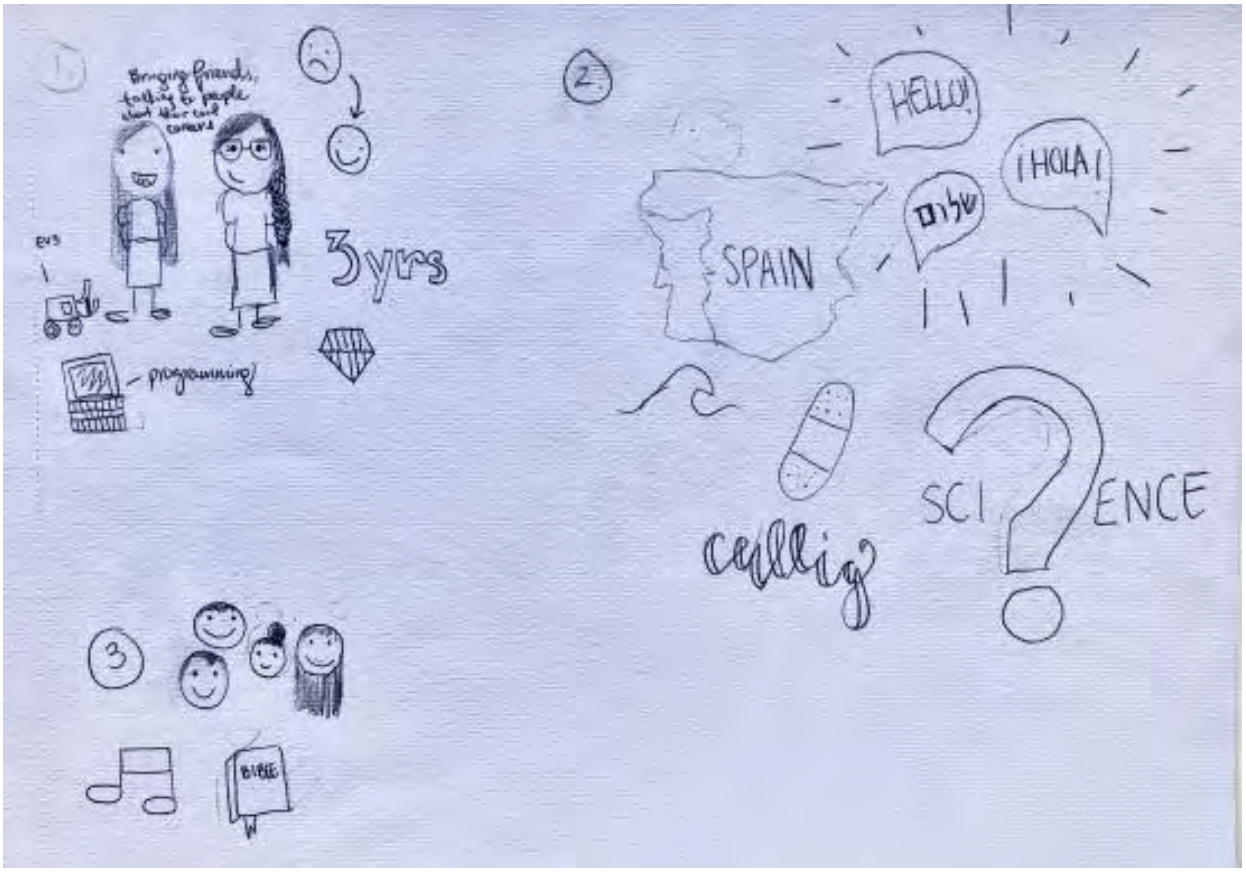

Figure 8. Savanna’s drawing.

Part two: Influences of program on Savanna ’s self-efficacy. Participating in the OST STEM program not only changed Savanna ’s attitudes toward STEM, but also increased her self-efficacy through different approaches. First of all, compared with the learning environments in formal schools, Girls in STEM program created a more flexible environment, giving girls more chances to make mistakes and try different ideas. As mentioned by Savanna , the OST program was different than her formal school, because “in a school, you couldn't mess up, cause if you messed up then that was something like really horrible.” With giving such freedom, the OST learning environment provided girls a larger scope of opportunities and therewith a broader range of behavioral options (Bergman et al., 2019). In the process of learning, girls could choose behaviors that best suit a desired outcome and thus develop related skills through practicing. Savanna described her perspectives of making mistakes in activities:

> When you didn't understand something, it wasn't like super open for you to, to mess up. You had to be able to be on top of it and figure out what you did wrong, um, by yourself. I was kind of like coming into that like, man, I can't mess up. I, I don't want to ask how to do it. And, um, but we had figured out how to do it. I'm still not the best at like working the programs. But, I feel like I'm a little bit more accepting of being able to, um, have whenever I mess up so that it's not like the only chance that I'll have to.

Furthermore, getting various learning experiences in the OST STEM program had a positive relationship with increasing personal mastery experiences, which is the most influential sources of constructing self-efficacy. In Savanna ’s case, she mainly gained authentic experience from communicating with different people and working on different projects (e.g., research paper and robotic competition). As Savanna mentioned, “I am definitely more confidence around people. Because sometimes for me, it can be hard to talk to other people, to communicate with other people. I'm learning to be able to do that to, to work with other people.” From SCT perspectives, successes from these experiences raise Savanna ’s mastery expectation; repeated failure lower them (Bandura, 1991). Thus, participating in the program gave her more confidence

in communicating with other people. Getting authentic learning experience in the program, Savanna ’s efficacy expectation were developed through repeated success. As a result, enhanced self-efficacy on communication changed her behavior that she became more open to talk to people.

Moreover, although repeated failure lower individual’s efficacy expectation, sustain efforts can enhance self-motivated determination and reduced the negative impact of occasional failures (Bandura, 1991). Participating in Girls in STEM program for three years, Savanna had experienced many failures. For example, Savanna described how her team worked on EV3 robot by saying:

> Sometimes we would have to, um, program the EV3 to, to perform certain tasks. sometimes my group members would like to, you know, to control the project and stuff. Because we weren't working like as a team, a lot of the times it wouldn't, it wouldn't work out. It would do like the complete opposite of what we wanted it to do.

However, the failures she gained from STEM activities and her engineering class at school made her realized failure is a common thing in learning engineering. She needed more efforts to overcome the challenges. She said:

> I feel like, um, with engineering you have to be a little bit more open to accepting failure. Because a lot of the times, you're not gonna get what you want like the first, the first try. And I definitely had a lot of that in my engineering class. Um, I mean I was already kind of used to it, but it's something that, um, you know, that you have to keep like working towards them.

Therefore, from Savanna ’s case, self-efficacy was developed through changing environment and personal behaviors, getting mastery experiences , and reducing negative impacts of failures.

Part three: Women in STEM. During the interviews, Savanna expressed her opinions of women in STEM. On the one hand, although there were not too female in science right now, but women is gaining more recognition in science fields. She said:

> I feel like, well, growing up, I don't think I knew a whole lot of female scientists, so I feel like it's something that, that by the time, I become a scientist or choose whatever career path that I'm going to take that, um, it won't be so, um, abnormal.

On the other hand, Savanna noticed the gender differences in choosing careers. For example, she mentioned "I wasn't sure what I wanted to be, um, but my brother did. He's younger than me, but, um, he always wanted to be an architect." When it came to the career choices, she said:

> I knew, the guys would kind of have, um, they would say that they wanted to do jobs and things like more, um, science-based things. And a lot of the girls would have, like they wanted it to be like ballerina if they wanted to do art based things.

In the future, Savanna was interested to choose a career path which could break the stigma between genders and stereotypes. From her perspectives, she believed:

> It's really great to be able to explore different opportunities and different things. I'm just kind of like breaking the stigma between genders and things that anybody can do whatever they set their mind to do. So, people should not have any stereotypes toward any female in STEM fields. It was great to be a female scientist.

To achieve these goals, Savanna indicated that she was not good at science and math, which might prevent her getting into STEM careers. As she said, "I feel like I'm good at science, I understand science, but math is hard for me. I'm not super good at math. I'm still learning to how to and be able to figure things out on my own." Thus, the lacking of abilities in math might prevent Savanna in pursuing STEM-related careers.

Summary. Savanna 's experience presented a high school girl's experiences in Girls in STEM. Different from Ariana's case, Savanna came to the program with low interests in learning engineering and programming. After three years' participation, she became more accepting to different disciplines. From her perspectives, integrating different subjects into STEM was a good thing for girls to explore more ideas. Getting support from people who have more experience was beneficial to her study. For her perspectives, the OST program was different than the formal

schools, providing more assistances and resources to learn and practice. As the results, she increased her self-efficacy and became more accepting to failure. In the last part, she expressed her expectation of breaking the gender bias and stereotypes. However, her low efficacy in math may become a barrier for her to pursue STEM.

Case Seven: Clara

Clara joined in Girls in STEM program three years ago and attended the summer camp twice. During her middle school years, she was the president of miniRobots STEM club. In ths summer 2019, she was participating in the megaResearch camp with Shaba and Kira. In Clara's case, I combined her drawing from art-based activities to describe her long-term learning experience in the Girls in STEM program. I mainly used SCT and SCCT model to explain how did the different learning experience influenced a high school girl' interests and goals.

Part one: Using tree and roll coaster as metaphors. In art-based activity, when came to question of "what is Girls in STEM?", Clara used a tree as a metaphor to show her perspectives of the program. As showed in Figure 9, she mentioned, "I drew is a tree with branches sticking out. Huge branches sticking out symbolize how I grew up, or like kind of grew, and like expanded my knowledge and science and engineering here at the camp." Furthermore, she listed many activities she participated before, including programming, robotics, and hands-on food activity. The first thing she drew on the tree was the computer, which presented as programming. As she mentioned, in the first year, she did not know anything about programming. Now, she knew more about it and were more interested in learning it. The next thing on the tree was the EV3 robot, because it was fun to play with. she also participated in the STEM club at her school and also became the president of the club. Besides that, she portrayed the Sushi because she learned so much about food in the camp and tasted food from other countries. The last thing she

placed on the top was the solar oven. In the summer 2019, she was making cookies with her partner in the research camp by using a solar oven.

Figure 9. Clara's drawing.

Additionally, as shown in figure 10, she used a roller coaster to show her experience in the Girls in STEM, because she experienced up and down in the process of learning. As she explained:

> When they first started here, I was really shy. I didn't know what I was doing. I didn't even know if I wanted to be there. And I just like see that like right there. I start at the bottom of the roller coaster. Over the years, like I just kind of grew up, like I went up. Because we had miniGirls at my school, I was really happy and that I was president of the miniRobots club. And it was for eighth grade, and it was every Friday morning. Like we would always have like a little meeting. I would always have so much fun. We made obstacle courses too. I felt like I could teach other girls too, cause like it was open for all the girls and some of those girls like weren't even in miniGirls.

From this paragraph, Clara expressed her excitement of being in a member of miniGirls and the president of the miniRobots. Through participating in Girls in STEM, she got a lot of fun with a group of girls who had similar experiences.

Figure 10. Clara's learning experience.

Compared with formal school, Clara expressed that the OST setting created an open and relaxed environment that made her feel more comfortable. In the program, she was given chances to do hands-on activities and worked with all other girls which is mainly intended to promote working in teams. As she mentioned:

> I feel more open here and I feel like, oh this is, I'm comfortable here. I guess I feel more relaxed. And at school I'm more like tenants. I'm more close and I don't, I just listened to the teacher and that's it. Like I don't really like talking but here I feel better. I feel like I have a voice.

Part two: Developing interests and goals from SCT and SCCT perspectives. Personal desires shape people's intention to act, thus preceding actions towards goals (Bandura, Caprara, Barbaranelli, Regalia, & Scabini, 2011). In the process of turning intention into career goals, personal factors and environmental factors operate as interacting determinants that influence one

another. Looking into Clara's case, her environments and learning experiences from different programs exposed her to a wide range of possible career-relevant behaviors. Whereas, the environments might limit the development of her interests, which also affected to achieve her goals in the future.

From SCCT perspectives, students are more likely to pursue careers in areas of interest and to achieve in subjects of interest (Nugent et al., 2010). Subject matter interest is positively related to school achievement, course enrollment decisions, and degree attainment. In this case, Clara was interested in learning different languages and cultures. When she was in the middle school, she had a linguistic teacher who could speak and teach multiple languages. During the process of learning Japanese, Clara had the ideas of being a translator or a speech therapist in the future. She also expected to learn more about how different people have different accents which results in different ways of talking. However, as Clara indicated, she was lacking resources to practice the speaking and listening in Japanese. She said:

> I like Japanese. I'm not as good as speaking it, but I'm better at reading and writing it because like, well I just took like online class, like I don't have anybody to talk to because it's online that I'm better at writing it and reading it and like listening.

Through participating in Girls in STEM, Clara was more interested in learning engineering and programming. The OST STEM continuously provided resources and opportunities for her. According to Lent et al. (1994), through repeated activities engagement, modeling, and feedback from others, children and adolescents developed a sense of like, dislikes, and indifferences regarding career-relevant activities and occupations. However, the social environment might not be favorable for her to pursue STEM.

The first issue was that many Clara friends were not interested in STEM, which might affect her personal desires to pursue STEM. As she demonstrated, "I'm really happy about this

place [program] and I want to show my friends about it. But they're just not interested, I guess." For example, she was disappointed that not many girls in her high school joined the robotic club. As she expressed, "we tried having miniRobots at my high school, but like not that many girls wanted to do it. I feel like because at Davison [A high school], we have so many organizations and like clubs and stuff like that people are just too busy or girls are just too busy like to go into anyone."

The second thing she noticed was learning science and programming seemed boring to many girls. She explained, those girls might have the misunderstandings that programming seems related to so much math and the STEM OST program seemed like another school. She said:

> I think because they look at it as school, like another school. I guess like the worst parts of school, cause it's science and engineering. I guess that sounds boring to some girls. Programming that seems like so much math. It's just basically like another school.

Additionally, Clara also mentioned others might have stereotypes that pursuing STEM career was such a nerd thing. However, Clara did not care about what others think about her. She said:

> People usually like tell me like, oh my God, you're such a nerd. I'm like, yes I am. And I'm proud of it cause like I am in so many organizations and like most of them are like STEM or like just educational purposes. And I'm proud of that, honestly. Like I really, I hope I could do something with this and I don't really care what other people say to me.

Thus, it is important to provide resources as well as create a beneficial environment for Clara to continuously develop her interest and achieve long-term goals.

Summary. Clara utilized two metaphors to present her perspectives and experiences in Girls in STEM program. As she revealed, programming, robotics, and hand-on activities were important components in the OST program. From her perspective, it was more comfortable to study in an OST learning environment as her voice could be heard. In the process of learning,

Clara gained more experience in learning STEM and became more interested in learning engineering and programming. Besides, Clara's case also presented the development of a high school student's interests and goals, exploring the environmental influences and issues of women in STEM.

Case Eight: Reya

Reya was an 7th grader who is studying in the SISD, Texas. She had participated in miniGirls summer camps in 2018 and 2019. By connecting with SCT and SCCT, I utilized Reya's case to illustrate the impact of family as a collective environment on a middle school girl's career development. In this case, I presented Reya's family background first, followed by exploring the family influences on children's development. I also illustrated the impact of participating in Girls in STEM program on her career development through providing more practical experience.

Part one: Family as a collective environment. The family is usually considered a major social institution, and a locus of much of the social activity of an individual. Family serves as the basic unit that provides love and affection to the children. From SCT perspectives, "the family operates as a multilevel social system with interdependent relationships rather than simply as a collection of members operating independently" (Bandura et al., 2011, p. 423).

Looking into Reya's case, family as a collective environment affected her development through building her efficacy and developing her personal interest. Every family member contributed to Reya's life circumstances and personal development. In this case, I mainly presented Reya's parents and her uncle. A little different than other girls in the study, Reya is the only kid in her family. As she mentioned, her parents were getting old. They were not familiar with technology things like her uncle. She mentioned:

> My dad especially like sometimes his computer will like have an error in it and he doesn't know how to fix it. He shows me the problem and usually I'm able to fix it and then if I'm not able to fix it, um, my mom will call my uncle because he lives in another state.

Thus, she became closer to her uncle rather than her parents and other relatives. As she mentioned, “sometimes it can be bad because I feel I had no one to live up other than my uncle or I had no one to try and make an impression.” Although she emotionally felt closer to her uncle, Reya revealed how her parents impacted her development. Her father arose her interests in cooking. As she mentioned, her dad loved cooking. So, he always taught her new recipes and practiced cooking with her. Whereas, her mom had a high expectations on her. She mentioned:

> I am trying make A's and B's and, and usually I try to make A's and because my mom. She's kind of like, it's okay that you can get a B, but I want you to get an A. And like I start freaking out whenever I get like a C grade. My mom has like really high expectations of me.

From Reya’s perspectives, her uncle influenced her a lot in the process of learning STEM. Reya’s uncle was a project manager in a technology company. His work included designing websites, creating online courses and fixing customers’ problems. She said, “He's like the smartest one in my family. He was the first one in my family to complete college.” Because the generation gap in Reya’s family, her uncle was helpful to provide resources (e.g., iPad and computers) and assisted her in solving technical problems whenever she needed. She described how she used these new technology-related products to learn programming:

> I had gotten an iPad for Christmas when I was like nine turning 10. At the time my mom didn't have anything apple and she, I don't even think she had a phone. My dad didn't get a phone until I was maybe 11. So it was mainly just kind of me having an iPad, like exploring all these new possibilities like YouTube, stuff like that. I also go on websites where I can program games. I haven't really found any good ones, but I try and find decent ones where I can program games and stuff like that.

In Reya’s experiences, she learned programming games from YouTube and started practicing animation on her computer. By practicing programming, she was getting more

interested in technology-related careers. She was attracted in being an app developer or a game developer in the future. She believed these two job fit into her abilities in art that she liked drawing people in action, making a storyline, and telling stories. As she expressed, “I'm kind of starting to add technology to my little list of career choices that I want to do. So I think technology might also be, um, a part, a contender for my career.”

In addition, family also shaped children’s development through the quality of family life and parents’ child-rearing practices (Bandura et al., 2011). Reya realized her family did not have a lot of money. She tried not to be a burden for her parents and spent a lot of money being in debt. So, she expected to get good grades in school and get into a good college with scholarships. She had a desire to try and help her family. Besides, she realized a lot of people who graduated from art school could not really find jobs in art. If she could find a good job in art, she had technology as an alternative, which made really good money. She mentioned:

> My family isn't really that um, rich like we don't have a lot of money but I'm gonna try and work hard so that way cause I know my grades now will affect how I, when I get into college and um, I want to get good grades so that way I can get into a good college. And that way I don't, my family doesn't have to worry about like, cause I know in some colleges you have to get accepted or you have to pay a bunch of money to them. And I don't really, I want to get accepted. I don't want my parents have the burden of just spending a lot of money in them being in debt. So I want to try and financially, yeah, I want to try and help them.

Part two: Learning in an OST STEM program. Participating in the miniGirls summer camp could be an supplement for her learning. As she mentioned, the program could give her an opportunity to practice her skills and get more experience about programming. She mentioned:

> I actually have a little robot, kind of that it's you also program it, but it's color coded. So when I go, when I use it for, when my uncle comes, he, he makes me use it, he's like, okay, what did you learn? Yeah. So I know at least I now know how to like, um, how to program easier so I can skip to like the advanced.

She had taught by her uncle that having a college degree and experiences were both important to get a good job. She said, “People are not only looking at your college, they also look at your experiences, but it also helps if you go to a good college.” Thus, Reya was excited to participate in the STEM summer camp. As she said, “there's always that feel like it was like excitement.” However, Reya expressed art-related activities were not enough in the camp. The program still needs to have a better balance of each subject. She expects to learn more art and do more art-related activities in the camp. As she expressed:

> I want to try and maybe include more art because I know it's new and it’s kind of always a rough start when you're adding something new to a program you've had. But definitely more arts stuff. Cause I, when I looked at the schedule, we only really have one day that have the two weeks. So, STEAM has five deliveries. Why not make a day for each one?

The knowledge she learned from the OST program could apply in the real-life, which boosted her confidence in doing similar things. From all of the experience, she could take that back with her and helped others solve problems. For example, she described how she helped her teacher to fix the computer. She said:

> One time I know the, the teacher, she was having trouble playing with the videos and that kind of reminded me like, hey, whenever we had trouble with, um, with like programming or hang like, let's say we needed to go turn it this way, right? Me and another girl went up. We were kind of telling our teacher what to do and it fixed the video. But we didn't really get to watch the movie because she couldn't find it.

Summary. Reya’s case presented how family as a collective environment impacted child’s career development through different aspects. In the process of turning intentions to certain actions and goals, personal and environmental factors influenced each other. When considering her future developing, financial factor affected her choices that she preferred to choose a job with a higher pay and needed scholarships to support advanced learning. In this case, Reya’s uncle provided resources and facilitated her to learn more about technology and programming. She also developed her own interests in doing programming. Similarly, the

miniGirls' camp provided certain STEM-related activities which met her needs. But she expressed the art-related activities were not enough in the camp to support her advanced learning. Her suggestion will be useful for program developers and educators when comes to the design of a STEM program.

Conclusion

As I stated in the beginning of the chapter, the qualitative single-case embedded case study collected data from personal in-depth interviews and art-based activities. Followed by Yin (2003) and Stake (1995)'s data analysis strategies, I conducted interpretative qualitative study to seek to understand the influences of participating in a STEAM program on Latinas. Eight participants were purposefully selected. They were middle school and high school girls who participated in Girls in STEM program for more than two years. The process of collecting and analyzing data led to eight embedded descriptive and exploratory cases. In each case, the researcher presented participant's backgrounds, learning experience of participating in Girls in STEM, and the influences of the program on participants' interests, self-efficacy, and career development.

Chapter 5: Discussion, Conclusion, and Implication

The purpose of this qualitative study was to understand middle school and high school girls' experiences in Girls in STEM program and to explore the influences of the program on girls' self-efficacy, interest, and career choices. To accomplish these purposes, I sought to answer a series of RQs concerning middle school and high school girls' learning experiences and the influences of an OST STEM program on their self-efficacy, interests, and career choices. To carry out this research, I featured a single-case embedded design by selecting eight middle school and high school Latinas to present the study. To better interpret the findings, I also included examples from other participants who were not included in the embedded cases.

I analyzed interviews and art-based activities from participants in Girls in STEM program through the lens of SCT and SCCT frameworks (Bandura, 2001; Lent et al., 1994). The SCT framework provided a triangle relationship between the behavior, personal, and environmental factors, which affected middle school and high school Latinas' self-efficacy and career interests. While, the SCCT framework provided a model of STEM career choice variables, including self-efficacy, outcome expectations, interests, and goals, which might guide career goals and actions for Hispanic girls' career development. Then, I used constant-comparative (Corbin & Strauss, 2008; Dyson & Genishi, 2005; Merriman, 2001) method to compare participants with different backgrounds and heavily relied on an understanding of themes and propositions which presented in the study.

Key findings showed that 1) the Girls in STEM program was beneficial in providing resources and opportunities that support girls who are studying in public schools with less STEM-related resources to learn STEM, 2) the program created a flexible learning environment, where girls could able to interact with adults from different STEM-related fields, contribute ideas

and complete various tasks with group members, and develop their skills in solving interdisciplinary problems, 3) the SCT and SCCT frameworks opened the experiences of the participants to analysis. In this study, environmental, personal, and behavioral factors all operated as interlocking mechanisms and influence on one another bidirectionally (Bandura, 2001; Lent et al., 1994). In the process of learning, girls mainly constructed their efficacy through performance accomplishments and vicarious experience. Once established, enhanced self-efficacy, along with outcome expectations, affected the formation of girls' interests, which influenced how girls created goals for further activity exposure, and 4) participants expressed desires to support their families financially and emotionally. Their social environments (e.g., family, culture, school) and socioeconomic status may limit their career options and affected career development.

In the following part, I interpreted the findings, by exploring participants' learning experiences in Girls in STEM, showing the application of the theoretical framework, and presenting the influences on girls' self-efficacy, interests, and career development. In the second part, I discussed participants' social environments, the barriers that prevent Latinas from participating in STEM fields, and characteristics of OST activities that increase Latina's interest in STEM. In the third part, I offered suggestions to improve Latina's STEM interests and demonstrated the implication for methodology. The limitation of the study and suggestions for further study were included in the last part.

Interpretation of the Findings

To better interpret the results, Figure 11 presented the relationships between learning experience, self-efficacy, interests, and goals. Various learning experiences along with social environment affected girls' career development. Looking into the career development process,

self-efficacy, interests, and goals all operate as interlocking mechanisms and influence on another bidirectionally. Each of these factors provided areas of focus to develop students' career pathways. In this study, self-efficacy as the most influential mechanism of personal agency, is mainly constructed through enactive mastery experience and vicarious experience. Self-efficacy also reflected students' feeling of participate in more STEM-related activities. While participants gained interest in STEM subjects from various learning experiences and social influences, but their interests and aspirations are not stable and do change after getting more experience. When it comes to goals, students would like more guidance from adults to explore career options and make plans. Socioeconomic status and social environment should be considered in the process of achieving goals and persisting in STEM fields. The following is the interpretation of the findings by research questions.

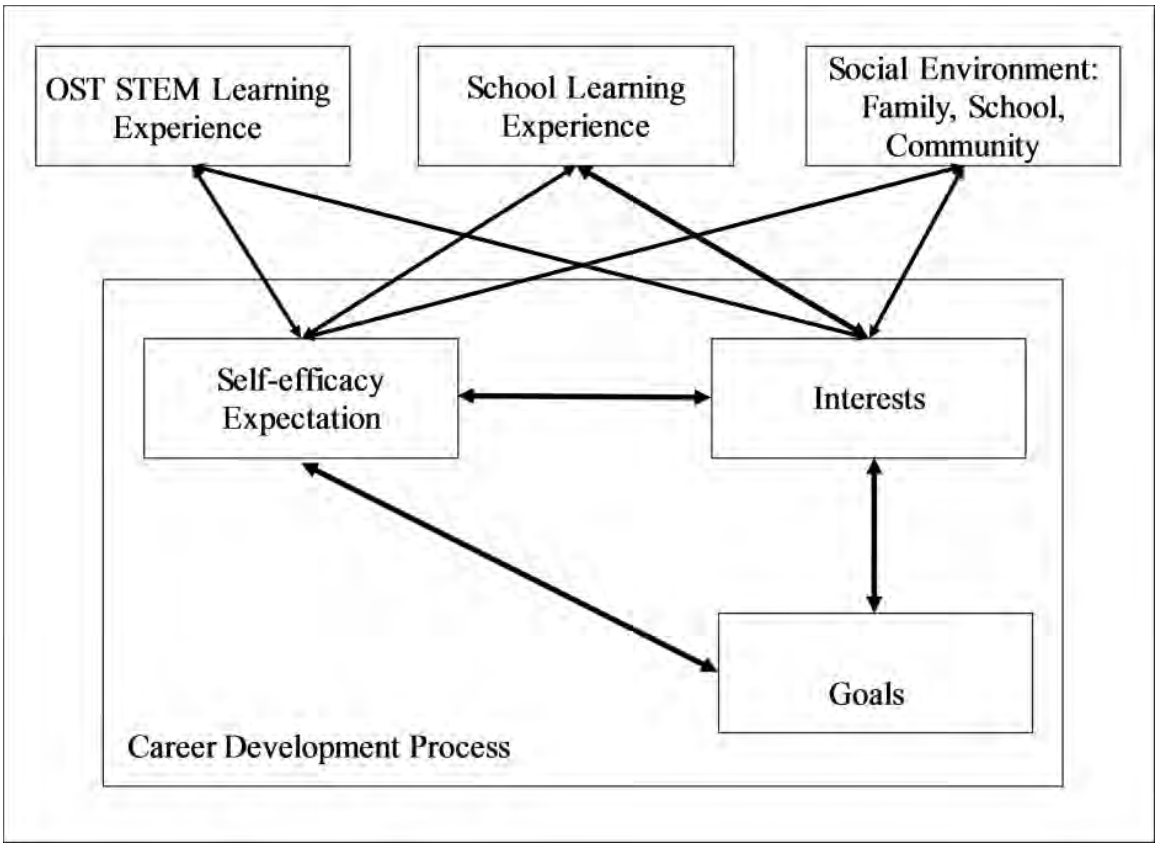

Figure 11. Framework of key findings.

Learning experience in the STEM OST program. The RQ1 is to answer what are girls' learning experiences of participating in Girls in STEM program. The data related to this RQ indicated two findings, 1) the program created a beneficial learning environment for participants, where they engaged in various activities and interacted with other girls and adults in the program, and 2) participants' learning experience, as the starting point of SCCT model, had influences on their self-efficacy, interests and further actions.

In the following part, I presented Girls in STEM as a selected learning environment through four parts, 1) girls' perspectives towards programs, 2) working with all-girls, 3) adult roles in an OST learning, and 4) experiencing personal growth. In addition, I discuss what influenced the girls' self-efficacy, interests, and career choices by applying SCT and SCCT frameworks.

Girls' perspectives towards Girls in STEM program. Students liked the fact that this STEM program was totally free and provided free transportation and meals for everyone. Most of the participants expressed there were not many programs like Girls in STEM program, which mainly focuses on providing opportunities for young women. For example, Amada mentioned, the program provided an opportunity for all the girls to do hands-on things that they never really did before. She stated that, "The camp is like a science and math-based club where we do different projects and it's, it's fun. We have to be creative and think outside the box of like that." Felisa also stated, that the program was beneficial and opened lots of doors for her. As she said:

> It is very beneficial for me. I say for like the future for college likewise anything that's like that can help me get in a good position for anything major or something that like, it really helped me, open lots of doors for me. For like, like I guess, a lot more knowledge of what they teach us and I could also, they made me applications something. They every want to try out for college.

Depending on the levels and types of the program, the girls presented different learning experiences. The participants agreed that the miniGirls summer camp focused on learning engineering and provided fun hands-on activities (e.g., programming and nutrition). While, in miniRobots Robotic club, students could apply the robotic concepts in real-life situations (i.e., FLL competition) and recap the knowledge that they have learned in the summer. As one girl mentioned:

> It's cool to see what then it happened the next day ‘cause you really don't know. And it's fun to get like, I like, hands-on activities and it's cool to see my friends like whenever like we would like we made jokes around in again, and said whenever they smile, and they can make me smile, because I like their happy, unhappy and whatever we're doing. I guess really fun.

However, the other two types of high school programs, megaGirls and megaResearch were more instruction based than the middle school program. MiniGirls summer camp was a learning process to learn robotics and make robots to complete goals. The camp had more creativity and outside of the box thinking than formal schools and normal classrooms. Whereas, students in megaGirls and megaResearch needed to be more accountable for themselves and more creative in the process of learning. This kind of experience would be beneficial for more high school girls’ who were entering into postsecondary education, as they become more familiar with the college life and learning environment. As a girl expressed:

> I have to be accountable for myself, especially in research. I have to be accountable for myself and make sure that I'm, I'm looking after the things that I need to look after and to make sure that I get something done and, um, I'm still working on it, making sure that I'm accountable for myself. ‘cause sometimes I, I slack off. But, um, I, I definitely feel like it, it was, um, it was a big push to, to make sure that I was, you know, getting things done.

Cooperative learning and all-girls learning environment. The program created a fun all-girls learning environment which was different from formal schools and traditional classrooms. By providing necessary materials (e.g., robots and drones) in the program, girls gained hands-on

experience and practiced skills which they could not usually get from the formal schools. The findings of this study are similar to much research, that the OST learning environment provided girls a larger scope of opportunities and therewith a broader range of behavioral options (Bergman et al., 2019). In the all-female learning environment, girls have more opportunities to speak and are more comfortable reporting ideas and doing problems in front of others (Morrow, 2006). For example, Savanna mentioned the program allowed girls to make mistakes and provide more chances to try different ideas. She explained that the OST program was different than her formal school, because "in a school, you couldn't mess up, cause if you messed up then that was something like really horrible." Clara's case demonstrates the program activities were more student-centered compared to formal schooling, which were more open and more relaxed than the formal school. As she explained:

> I feel more open here and I feel like, oh this is, I'm comfortable here. I guess I feel more relaxed. And at school I'm more like tenants. I'm more close and I don't, I just listened to the teacher and that's it. Like I don't really like talking but here I feel better. I feel like I have a voice.

Communication and cooperation were two important components in the program and were required for each activity. These two components are commonly applied in many OST programs and are essential to creating an effective cooperative learning environment and small-group work (Steinthorsdottir, Forgasz, Becker, & Lee, 2010). For example, one girl (Figure 12) described her experience of working in teams by saying:

> For the first one, it was my experience or like something that describes miniGirls summer camp. Um, and over all I learned how to work with people and friendship and just like working together to like come up with the new ideas.

In the process of working on projects, girls worked together, figured out the problems, and developed the necessary skills to complete the tasks. When girls had different ideas, they could exchange their ideas and find effective ways to combine with others without creating

conflicts. By providing opportunities for cooperative learning, girls could utilize verbal and social skills to maximize the benefits of the STEM program (Holba, 2015). As a result of effective teamwork, solutions have been improved significantly. According to Bandura (1977), occasional failures which are later resolved by a determined effort can enhance self-motivated determination if students learn through experience that sustained effort can conquer the obstacles. The sense of achievement in the activities would offset the frustrating moments and motivate girls to learn more in the camp.

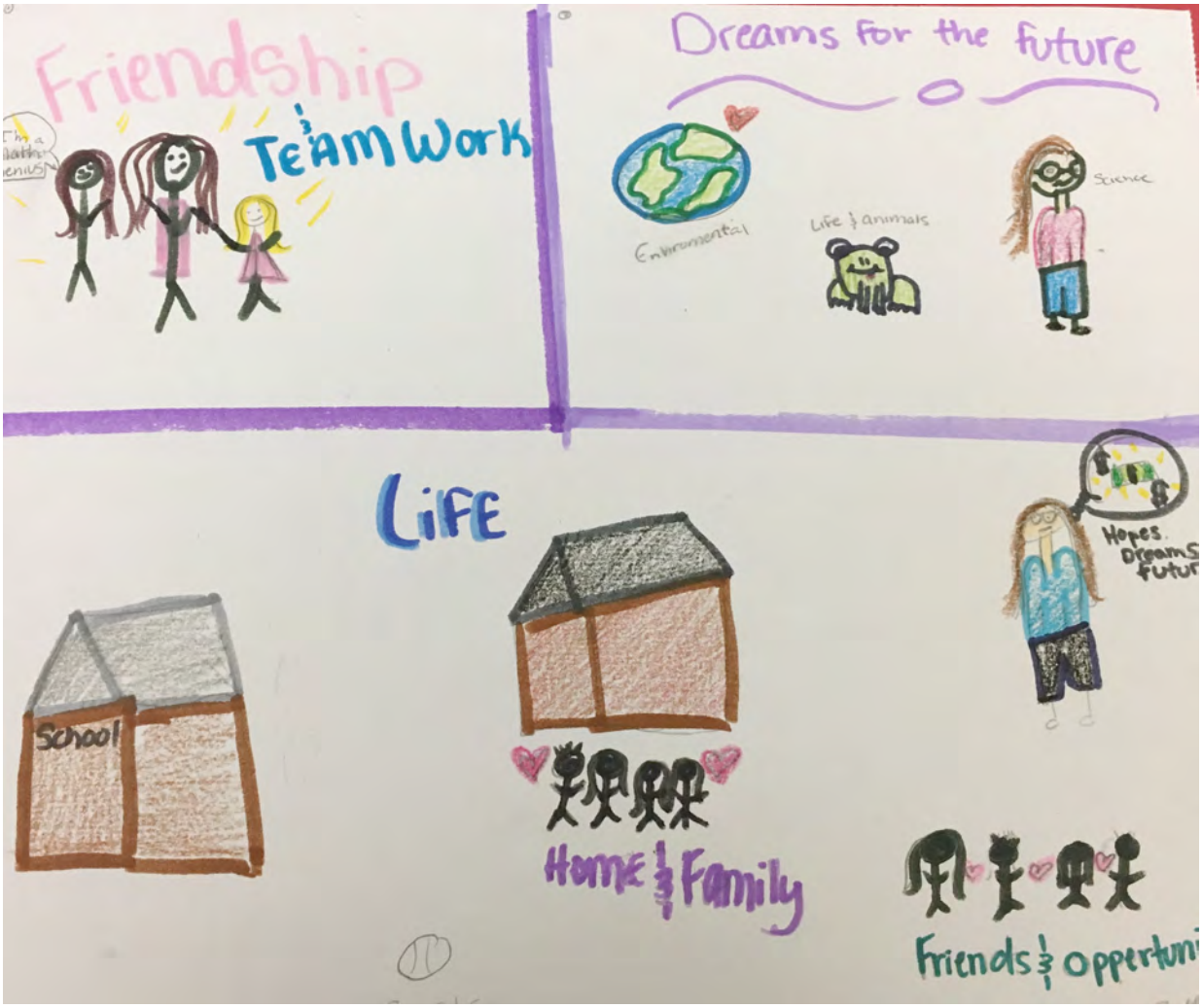

Figure 12. Learning experience in STEM program.

All the eight embedded cases demonstrated that the experience of working with other girls helped make new friends, learn from different perspectives, and achieve better performances. These findings were similar to the prior studies that all-girls learning in the camp is conducted under less distractions and less tensions than mixed gender (Wang & Frye, 2019). Compared with students of different ages, cooperation in single-sex education is especially important in the middle grades (Spielhagen, 2006). For example, in Elisa's case, in the process of working on projects, she made new friends who solved problems together and had similar experiences with her. As she expressed:

> I got to talk to more people. I got to work on these projects with other people, which can build a kind of different bond than just talking to someone because you've experienced that stress together and you've experienced that, like that sadness or that worry together and you've gotten each other through it. So it's more of a stronger bond.

Similarly, Felisa expressed that she felt more comfortable and more confidential to work with girls, because there was less tension and less negativity opinions than worked with smarter boys. She said, "When girls and girls work together, they feel more comfortable because it's not that much weight than work with boys like they tend to be, made them, want to be smarter. We generally think that we're the best."

Adult roles in OST learning environment. Research demonstrated that mentors play important roles in OST activities (Bozionelos, 2004; Dolenc, 2013). An effective OST environment is physically and emotionally comfortable with positive mentorship developed through team-building and other activities (Steinthorsdottir et al., 2010). In Girls in STEM program, adults interacted with students in different ways and played various roles to provide better mentorships and assistantships for middle school and high school girls. Most of the participants desired to get assistance and support from adults in Girls in STEM program. As Savanna mentioned:

> I would understand it better than if somebody, like Tommy, like someone else, who, um, outside of the program were to explain it to me. And I feel like I can take that back to my school and to be able to explain those things to other people.

Depending on the level of mentor involvement, the effects of mentorship varied. Heavy mentor involvement may expose students to the correct way to conduct a learning process, but it may remove opportunities by not allowing students to become more engaged and to learn by doing it (Dolenc, 2013). The results revealed that Girls in STEM created an effective OST environment where participants interacted with peers, mentors, and teachers in different ways in an OST setting. Adults in the program had sufficient knowledge to support the developmental growth of youth from a wide variety of backgrounds. Together, students and adults (mentors, teachers, peers) build a positive learning environment and form a sense of community. For example, Clara described how she liked the fact that camp counselors served as a facilitator to pushed them to be creative in the activity. She said:

> I remember we had high school counselors. If we had any troubles with the activities that we were doing, she would help us like, not like give us direct directions, like instructions. Like she wouldn't tell us, oh, do this. She would like, like push us so we could think outside the box.

Similar as Kara, “he [a male camp counselor] just like helps us out in what we need help. But um, he didn't really like, like give us like a class of it. He just sees, like, our problem and teach us Like how to like fix it.”

Adults in the OST STEAM program influenced students’ learning and development by providing support and career information. On the one hand, adults, especially camp counselors were useful for providing technical and emotional supports, which helped students reduce stress and complete tasks. In the program, students had opportunities to work on their own robots and test all the positional solutions out in robotic activities. However, working on robots was a challenging task for most of the girls. Students experienced negative emotions (e.g., stressful,

sad, frustrations) when solutions did not work, the problem repeatedly occurred, and activities were not well-organized. Girls felt frustrated in the first day of EV3 robotic activities. Once they practiced those activities and applied the knowledge into the competition, they became better and started to think of new ideas. Therefore, when students had a negative experience, team members and people in the program (e.g., camp counselors and teachers) could talk to them to reduce students' stressfulness and help through the challenges. As Savanna mentioned:

> Sometimes I'm just like, I can't do this. And they're like, no girl, you got this, we believe in you. Like you can do this. She's like, take your time. He's like, if not, just ask for help. Don't be afraid to ask for help. At least I, and I know like I can go to somebody and there'll be there.

On the other hand, guest speakers provided useful information for students to explore different fields, which may have positive influences on students' development. Brown (2008) notes that getting career-oriented information may be particularly difficult for students from underserved populations or for those whose family members have not attended college. Thus, in the OST program, providing career-oriented information is important to create an effective STEM program (Steinthorsdottir et al., 2010). In this study, as many girls mentioned, guest speakers played an important role in opening her thoughts and pushing her future in higher expectations. For example, Felicia mentioned, "I would see myself in their positions or if I want to see myself on their positions, and I want to make like a goal or something of what I want to do when I get older." Similarly, Nora said:

> She [the guest speaker] told us like, see all these women made it. So, you guys can do it too. Like you guys can change the world. US women can do it. Like our group right here can all do it. So it made us like more positive.

Therefore, mentoring is an essential component of Girls in STEM program and was beneficial for students' development. In the OST program, adults played the role of a person of resources and allowed students to make most of the decisions and complete the task with other

girls (Dolenc, 2013). It is important for staff members engaged in positive and supportive interactions with participants in an OST setting. Through building a positive student-mentor relationship, experienced adults provided ongoing guidance, instruction, and encouragement, which helped students overcome challenges and develop competences.

Experiencing personal growth. Students were expanding their knowledge and experiencing personal growth at the same time of participating along with the camp. Girls who participated in two summer camps or had two years' experience in Girls in STEM program, recognized that they were getting familiar with the activities. The experience they gained from the first time/year helped them to overcome the negative emotions and develop a stronger sense of teamwork. For example, in Elisa's second year, she had more experience with coding and became more calm with robots. Specifically, she mentioned the robotic competition was less stressful for her and she achieved better performance in the competition. She said:

> To be very honest. I've gotten like more calm about the robots and it felt easier this [second] year when we were like putting together the EV3 and doing the coding the first time I was like, Hey, I remember some of this stuff like that. It was like, yeah, I know this stuff. Woo.

As for the students who had longer experiences, they experienced personal growth that the activities in the STEM program became much easier than before. In Clara's case, participating in Girls in STEM helped her open up and broaden her knowledge in science. As she mentioned, "I grew up like I remember…I know more about programming and really love it and I really, I really like science now. I really love it." Now, the activities in the program appeared easy for her. As she mentioned, the moments she worked with her groups were valuable in her life. She said:

> We were like the chill-out girls and remember that like we like every group had to make up their own like little slogans and stuff like that. And I think that's it. And we made a little like an ad [advertisement], like hey buy our ab three or a little robot, it picks up dirt.

> It was pretty hard. But we did it like, like I was in middle school. Like it seemed right now of like how I'm saying it, it seems so easy. But it was pretty hard like for middle school.

Additionally, some girls kept coming back to be mentors, campers, or volunteers and also brought friends to participate in the program. For example, Savanna's drew two girls in her drawing. As she expressed, she brought her friends Kira into the program, because they had similar interests. In the camp, they worked on a research project as partners, where they shared similar experiences and developed a stronger bond.

In summary, the diverse programs in Girls in STEM program met different students' needs. This study revealed that it is important to provide middle school girls a fun learning experience, while high school girls needed more flexibility to develop a sense of responsibilities and more creativity in the learning process. Furthermore, Girls in STEM program created a supportive and cooperative learning environment for girls which was different from the formal schools' environments. Participants expressed that they felt more comfortable and more flexible to work with other girls in the OST STEM program. The experiences of working with other girls helped them make new friends, learn from different perspectives, and achieve better performances in certain tasks. In the learning process, adults from different backgrounds played important roles that they provided information, resources, and supports for middle school and high school girls. Moreover, after long-term participation, students experienced personal growth that they were getting familiar with activities and more interested in learning STEM. The following part is building connections between girl's learning experience with their self-efficacy, interests, and career choices.

What influenced girls' self-efficacy, interests, and career choices? This part applied SCT and SCCT frameworks to explore what influenced participants' self-efficacy, interests, and

career choices. The study reflected the interdependent relationships between environmental, personal, and behavior factors and presented how girls developed their interests and career pathways through the mechanism of self-efficacy and outcome expectation. I presented the results through the following three aspects, 1) factors that affected girls' self-efficacy, 2) formation of interests, and 3) factors that affected girls' career aspiration, choices and goals.

Construction of girls' self-efficacy. Bandura (1977) stated that perceived self-efficacy is constructed from four sources: "enactive mastery experiences, vicarious experience, verbal persuasion, and physiological states" (p. 195). The findings of this study mainly explored two resources of self-efficacy, enactive mastery experience and vicarious experience.

Enactive mastery experience. From self-efficacy theory, the most influential source of participants' self-efficacy was enacting mastery experiences, which provided the most authentic evidence of their STEM capabilities. Successful experiences raise the efficacy, whereas failures may lower it (Bandura, 1977). In this study, most girls expressed their positive experiences through different practices, which developed their skills and increased their efficacy. For example, Savanna and Nora both mentioned that communicating with different people boosted their confidence in communication skills. After participating in the camp, they became more open to talking to people. Especially, when it comes to engineering related things, they had more confidence in themselves.

Whereas, participants also mentioned their negative experiences had mainly resulted from failures in the process of working with robots. Negative impacts occurred when problems repeatedly happened and the activities were lacking assistances. According to Bandura (1977), "Occasional failures that are later overcome by determined effort can strengthen self-motivated persistence if one finds through experience that even the most difficult obstacles can be mastered

by sustained effort" (p. 195). Not all of the performance attainments impact on efficacy beliefs. Bandura (1977) further explains that "the same level of performance success may raise, leave unaffected, or lower perceived self-efficacy depending on how various personal and situational contributors are interpreted and weighted" (p. 81).

In this study, through working with group members and getting more experience, girls were motivated to generate more ideas to complete the tasks, building stronger efficacy expectations through getting more success. As a result, occasional failures were likely to be reduced (Bandura, 1977). For example, in Savanna's case, she experienced many failures in participating Girls in STEM program and taking the engineering class at school. But she expressed that these failures made her realize that failure is a common thing in learning engineering, and she needed more efforts to overcome the challenges. As she mentioned:

> I feel like, um, with engineering you have to be a little bit more open to accepting failure. Because a lot of the times, you're not gonna get what you want like the first, the first try. And I definitely had a lot of that in my engineering class. Um, I mean I was already kind of used to it, but it's something that, um, you know, that you have to keep like working towards them.

Vicarious experience. People do not rely on experience mastery as the sole source of their self-efficacy. Many expectations are derived from vicarious experiences, which emphasized the power of social comparisons (Bandra, 1977). For instance, working with other girls in the OST program, comparison took a significant part in constructing Elisa's self-efficacy. As she described, she usually compared herself with others by saying "Why I cannot do it? why others can do it?" It was uncomfortable for her to compete with girls who had more experience and achieved better performance. The negative attitudes became stronger when other people were getting it right and she got it wrong. As a result, these negative experiences and attitudes directly affected her confidence in other robotic or programming related activities. As she mentioned:

> I'd probably mess up a lot and I probably wouldn't like that because it would be like so many different people and like I may feel bad because those people may have more experience and maybe much better than me and then I'll beat up on myself and that's not good.

In addition, modeling and modeled behavior in vicarious processes were presented in this study. According to Bandura (1977), "seeing others perform threatening activities without adverse consequences can generate expectations in observers that they too will improve if they intensify and persist in their efforts" (p. 197). In this study, participants showed a higher desire to break the stigma between gender and increased their self-efficacy in pursuing STEM fields. For example, Nora mentioned she learned several famous women in STEM fields in an activity in the OST program. After learning from their stories, Nora changed her idea and expressed girls also have the power to make the world different. As she said:

> She [the guest speaker] told us like, see all these women made it. So you guys can do it too. Like you guys can change the world. US women can do it. Like our group right here can all do it. So it made us like more positive.

Similarly, Felisa mentioned some female speakers in the program motivated her to have higher expectations for her future. As she said, "I would see myself in their positions or if I want to see myself on their positions. and I want to make like a goal or something of what I want to do when I get older."

Therefore, in this study, self-efficacy was heavily affected by performance accomplishments and vicarious experience. The learning experience in the OST program provided sufficient resources to strengthen participants' efficacy in different aspects. Through substantiating comparative information, students enhance the perceptions of their performance capabilities. Particularly, the modeling approach utilized successful women's performances in STEM to enhance students' efficacy of women in STEM and promote students' psychological change.

Formation of interests. From SCCT perspectives, students' environment directly or indirectly exposed to diverse activities from others which helped them reinforce the ideas of pursuing certain activities. Through repeated activities engagement, modeling, and feedback from others, children developed a sense of like, dislikes, and indifferences regarding career-relevant activities and occupations (Lent et al., 1994). In the process of forming interests, self-efficacy is seen as a predictor of interests; in bidirectional relationship, interests promote opportunities for self-efficacy development and affect career orientation through outcome expectancy and self-efficacy (Lent et al., 1994; Nugent et al., 2010). In this study, most girls demonstrated that they were interested in the subjects or careers which they had practical or successful experiences before. The learning experience from various in- and out-of-school programs helped develop middle school and high school girls' interests.

In school, students chose to take extracurricular courses (e.g., gifted program, international baccalaureate program, pre-ap class) where they can develop their interests in certain subjects and career fields. For instance, several girls mentioned they became interested in learning languages (Japanese and Chinese) after taking language class in her middle school. As one girl expressed:

> I'm really interested in linguistics, and right now, I'm learning slash kind of know Japanese. So I kind of wanna teach Japanese, like in Japan to um, teach crap. Um, I either want to like stay here and teach Japanese or go to Japan and teach English.

While, in out-of-school settings, students' interests could be developed through other informal and non-formal learning experiences, such as participating in sport teams in school, making bath booms with parents at home, and helping others in the community.

In this study, the formation of participants' interests not only related to their self-efficacy but also greatly affected by environmental factors. From the SCT perspective, "the family

operates as a multilevel social system with interdependent relationships rather than simply as a collection of members operating independently" (Bandura et al., 2011, p. 423). Family serves as a collective environment had a significant influence on developing girls' efficacy and interests. Many participants in this study revealed their interests were influenced by their family members' careers, lifestyles, and values. For example, in Reya's case, her father raised her interest in cooking by teaching her new recipes and practicing cooking with her. Another example of family influence was Amada. Amada's mother expected that she would take care of other children. As she said, "I am influencing by my mom, being a good mother and a good cooker and all of that for taking care her children and all that."

In addition, the results demonstrated the participants, especially middle school girls' interests and aspirations are not fixed and do change after getting more experience and possibilities. As Rosenthal (2017) mentioned, students would like more help in the area of career planning, as their career interests are not stable before college. In Nora's case, participating in different activities helped her recognize what she really interested in. She even expressed high interests in learning STEM, but she was still changing her interests. As she said:

> I've found a new interest in like, um, and like civil rights and all that. I started to think about that this year and so it's got me more interested in now. Um, but I, um, I came here to like, have this as like a backup. So if I don't, like, if I don't end up doing that, I just, I can choose engineering.

Thus, the students developed a sense of their likes and dislikes from various learning experiences. The increase of self-efficacy as well as environmental factors affected the formation of students' interests.

Factors affected girls' career choices. Social environment is an influential factor that affected participants' career aspirations. In the study, most participants indicated they had desires to change their social environment, such us community, school, and neighborhood. They wanted

to change others' perspectives of the area and school they were in. For example, Ariana expressed people's discriminatory words about her surroundings and school were annoying and confusing. She and her mom expected to change these perceptions by proving the area and school were not that bad. Similarly, Elisa's case showed her dissatisfaction with her surroundings, which made her more concerned and aware of her situation. After observing the issues in her community, she wanted to become a lawyer or a therapist to help more people.

Furthermore, family influences, as a big part of the social environment, impacted girls' career aspirations as well. According to Bandura (2001), parental influence on children's academic development has been extensively researched, while how parents affect their children's career development has gained little attention. The findings of this study presented how family members affected Latina's career choices. The study showed family members mainly affected their children through their effect on career choice and self-efficacy appraisal.

On the one hand, family members provided information about career choices and offered their perspectives on particular careers. In Reya's case, she mentioned she was taught by her uncle that having both a college degree and experiences were equally important to getting a good job. She said, "People are not only looking at your college, they also look at your experiences, but it also helps if you go to a good college." Similarly, Amada's interest in becoming a mechanical engineer was influenced by her father, as he was working in the car-related fields and learning carpentry. Through learning from her father's experience, Amada gained interest in fixing cars as a mechanical engineer.

Most girls' families were supportive in developing their interests, which may help girls in selecting careers they were interested in. Savanna mentioned, her family always encouraged her to do whatever she thought best in everything and helped her find new ways of learning. Her

friends also motivated her to find more opportunities and prepare for STEM careers, because many of them started getting internships and applying for research programs in other universities. All of these external factors gave her a push towards taking a right step in order to achieve her goals. Thus, family has a significant influence on cultivating children's career aspirations. In the process of developing career goals, family support is an indispensable attribution.

In summary, this part presented the factors that affected participants' self-efficacy, interests, and career development following by the SCT and SCCT frameworks. Students' environment exposes them to a wide range of possible career-relevant behaviors (Lent et al., 1994). The learning experience from various environments directly or indirectly helped them reinforce the ideas of pursuing certain activities. Students developed a sense of their likes, dislikes, and indifferences regarding career-relevant activities and occupations. Through enhancing their efficacy, students developed their interests. In the process of growing interests, people also develop their intentions or goals for learning more about related activities. Personal factors, behavioral patterns, and environmental events play an important role in strengthening an individual's self-efficacy, forming interests, and developing future plans (Bandura, 1989, 2001). It is important to note that a large portion of students in middle school and high school do not have stable interests and aspirations. It is necessary to offer more valuable learning experiences for students, providing more possibilities to develop their interests and therewith support career development.

Influences of the STEM OST program on participants: Self-efficacy, identity, interests, and career choices. The second and third research questions explore how and to what extent does the program influenced girls' self-efficacy, interests, and career choices. The OST

STEM program in this study falls into a part of participants' social environment, which was viewed as a selected and structured environment. This environment provides the largest scope of human behavior and therewith the broadest range of agentive space (Bergman et al., 2019). In a selected environment, individuals formulate appropriate action and decide how to behave. They can choose behaviors that best suit a desired outcome in a specific situation. Thus, some girls expressed they gained more experiences, developed a sense of belonging, and advanced their interests in STEM in the process of participating in different camps. The following presents the influences of Girls on STEAM program on girls' self-efficacy, STEM identity, interests in STEM learning, and career development.

Increasing girls' self-efficacy. According to Bandura (1977), perceived self-efficacy have directive influences on choice of activities and settings. Through efficacy expectations, students determine how much effort they will expend and how long they will persist in the face of obstacles and aversive experiences. Students' self-efficacy beliefs are the foundation for entrance and persistence in the STEM profession (Brown et al., 2016). Students will be more likely to pursue a career or an educational path toward a career if they have a high self-efficacy (Ernst et al., 2014). The results of this study showed participating in Girls in STEM program had a positive influence on girls' self-efficacy, which may be important for future performance, participation, and quality of experience for females in the STEM disciplines. The increased self-efficacy can be found within a higher self-confidence in learning STEM-related subjects and a higher level of willingness to communicate.

On the one hand, several participants expressed they were more confident in math and engineering after participating in the OST STEM camp. For example, Elisa expressed participating in Girls in STEM program helped boost her confidence in math. As she expressed:

> I feel way confident than what I did last year in math. Math, I was [in last year], I still had a good grade in math, but I did not like it as much as I do this year. This year I have grown 100% than what I had did in last year. Last year I already had got like 14 questions right on the start test. And this year I've gotten up to like 20 questions right. So I am hopefully I'm growing…because of miniGirls, I feel more confident in numbers, like more like, like, oh, I didn't even know how to say it. I feel like if I just stay in miniGirls, I will be more like, I'll get better at math and science.

Whereas, some participants were not selected as embedded cases, their data were available through the art-based activity and interviews. One middle school girl mentioned she became more confident in herself when it comes to engineering things. Another middle school girl expressed:

> It [the program] gave me confidence, like, with um, like with the team building we like had to get to know each other. Then the math and art. We were able to like collaborate with other people, share new ideas, apply those ideas.

Kira who conducted a research project with Savanna in the summer of 2019 stated, "Yes, I feel I have more confidence with just the unity part…because like I'm really like new to it cause I don't really like programs and stuff like that in school. So that was like a little bit challenging."

On the other hand, working with other girls in a cooperative learning environment increased students' confidences in communication. As an all-girls program, teamwork and communication were involved in every activity. Students did different projects with girls who were in different schools and grades. They had to work together, integrate different perspectives, and be creative in finding the solutions. In the process of learning, they made new friends, got help from others, and also offered help to others, which in turn, improves their communication skills and increasing their confidence in communicating with others. For example, Nora expressed that by working together with girls, she became more open to others. As the first year in the program, she was scared of working others. Now, she could guide others in doing robotics. She said:

> When I was here for many times, the first year I kind of just like, didn't want to be like around people. I don't, I like, I was scared or something. And then like every, like other year I've been coming, I think, um, the fact that I'm like around all these other people, like last year we had another school and like we made it, um, friends, I still talk to her and I'm like right now we're making new friends, like the people in our groups. So it makes me feel like I can actually like talk because in the first year I had a group and I didn't, I didn't know what to do 'cause I don't know how to code because um, they were like eighth graders that were doing all their work and they wouldn't let me. And so now that, now, um, even if I'm doing all the coding or something, I like, I try to get them to the people in my group to um, code with me or help me or like me and Lexi to help us.

Develop girls' STEM identities. As can be inferred from Bandura's SCT, self-efficacy is consisted of four sources which serve as an internalized evaluation about a person (Bandura, 1977). Research also demonstrates the concept of social identity from social identity theory have significant relationship with self-efficacy and serve as the external sources of self-efficacy (Guan & So, 2016; O'Brien, Martinez-Pons, & Kopala, 1999; Tajfel, 1982). STEM identity is viewed as a type of social identity, which asked the questions of "who I am as a group member?" (Kim et al., 2018). It is a socially based identity which relates to how individuals see themselves, how they view a sense of fitting in STEM, and how they recognize themselves as a group member in STEM fields. The social environment provides a variety of signals that STEM fields are dominated by white, male, and middle class. Consequently, students of color, female, and those from lower socioeconomic family struggle with the development of a positive STEM identity, which will influence their perceived self-efficacy (Hughes et al., 2013; Kim et al., 2018).

The participation experience in the Girls in STEM program helped todevelop diverse STEM identities which could give girls the competence and confidence to see themselves as members of the STEM community and complete STEM activities. Many participants revealed they developed a sense of belonging because they were proud of being a member in this program and felt their opinion had been heard. The increased identity opened up opportunities for students with different interests to be involved and maintained high retention rates (Dolenc, 2013). For

example, Nora mentioned, she was happy to be recognized and admired by students, teachers, and administrators in her school. As she described, girls in the club usually wore pink shirts on Thursday and Fridays for spirit days. People in the schools started getting familiar with girls in the camp. As she mentioned:

> We also wear pink shirts on Thursdays and Fridays for spirit days. So it was kind of cool cause everyone like kind of admired us. Like the teachers. I was like, Oh, you're in miniGirls. And then the president when he started getting more into it. Yeah. Yeah. He's already knowing who, like who were the people that were in miniGirls.

Similarly, in Ariana's case, she expressed that she was proud of being a member of the program because it was an excited thing to share her experience and got a sense of appreciation for her family members As she described:

> When my mom talks about it [Girls in STEM] to my family members, I feel like, yes, I know this program. Because they end up like, whoa, what did you do? And then I explain to what I do and then they're like, oh my God, you're really smart.

Furthermore, girls expressed the OST program is a great way for women who want to get a higher education and involved in STEM fields in the future. The activities in the program gave opportunities for girls to combine ideas and work together. Participation in OST helps students to expand their identities as achievers in the context of science, engineering, mathematical, and programming. As Nora mentioned:

> She [the guest speaker] told us like, see all these women made it. So you guys can do it too. Like you guys can change the world. US women can do it. Like our group right here can all do it. So it made us like more positive.

Vocational interests in STEM fields. Lent et al. (1994) defined vocational interests as "patterns of likes, dislikes, and indifferences regarding career-relevant activities and occupations" (p. 88). The vocational interests reflect on question "Do I want to do this and why?" (Wigfield & Eccles, 2010). This study found that Girls in STEM program facilitated students' STEM learning and helped develop students' interests in learning STEM. The program

created a fun environment for girls to learn various STEM related concepts, such as robotics, programming, graphic design. The knowledge the girls learned from Girls in STEM program could apply in their advanced study and future careers. For middle school girls, they increased their efficacy in mathematics and could apply the knowledge to helping others. For high school girls, the participation experiences from the program could help them become familiar with a college environment. Furthermore, these learning experiences motivated the girls to participate in more STEM activities and take extra STEM-related classes in their schools. As mentioned by Alyssa, she planned to go to a high school which could offer an engineering class. In order to learn more about engineering, Sarah, a high school girls, took an extra engineering class in her school. Additionally, in Figure 13, one girl described how the STEM program affected her career interests. She said:

> I met a bunch of people last and this year, last year and this year. And I learned a lot about engineering. And right now I'm learning Python in like, my school. So I wanted to do something to create like, anything on the computer using Python, my own, like, using coding language. I want to make something ‘cause engineering is always, they're always making something. So I wanted to be an engineer, still working on the kind.

The presentations made by different people (e.g., guest speakers, visitors, and camp counselors) in the program, broaden the ways participants’ learn STEM concepts and keeping their career options open. Girls expressed that they did not normally have chances to talk to these people during the academic years. Most participants expressed that the presentation provided useful information (e.g., career, enrichment activities) they never looked into and gave them wider ideas in forming their career interests. The presentation was especially beneficial for middle school girls who were forming their interests and expecting more guidance. For instance, one girl mentioned her favorite thing in the past three years’ experience, was one presentation which made by a guest speaker. She said:

> "I think it's when she said aerospace or something like that, and she was presenting what they do and what happened…it's very interesting because it was based on like on the like space. So I liked the presentations that they were getting good. The like, me like, when we on like, tours and the fellowships around the school, it'll be cool."

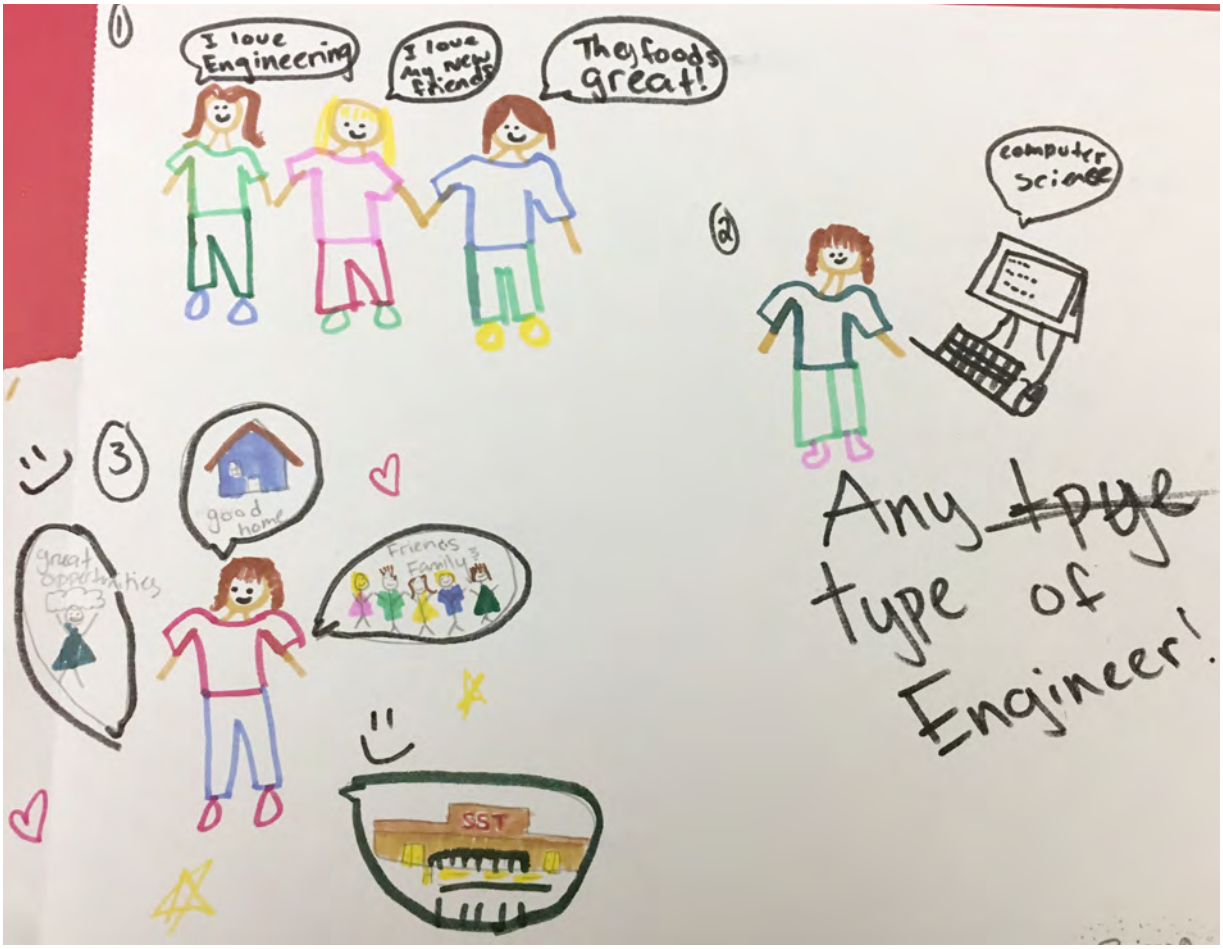

Figure 13. STEM program and career interests.

Influences on career choices and goals. When making career choices, students are more likely to pursue and achieve careers in areas of interests (Nugent et al., 2010). Many participants expressed that they were interested in careers which involved in helping others. Similar findings have been presented in literature that female are more interested in careers whey they can help others and in which they can make the world better (Clapham et al., 2015; Sadler et al., 2012). For example, Ariana wanted to be dermatologist, because she wanted to create new medicines

for helping people who had different skin conditions. Elisa wanted to be a therapist to help people who had family issues in her community.

This study demonstrated that gender disparities exist in career aspirations and pursuits and that not many of girls are choosing careers in science and technical fields. Many girls in this study realized the gender bias and stereotypes towards women in STEM. As one girl expressed her perspectives of gender bias by saying:

> With them being sexist, it's kind of bad because we females we probably don't have as much style as the men cause due to them like having been very picky. We're also picky but we like, work harder to achieve that cause just ‘cause people think that men do better than women when actually women work harder. We, we try harder. I'm not saying that the, that the men don't try, I'm just saying that based on our genders it's just very bad. Just for, just for us, not for us. Working really hard, not being able to be the top then just like that.

However, after participating in STEM program, many girls are showing the willingness to take STEM-related careers as the alternative choices. For example, Reya mentioned:

> If I don't find a good job in art, then at least I have an alternative. I can go into technology, which I know makes good money and I know has really good. Um, they make good money and it's also something else that I'm interested in. So miniGirls, it's kind of a way for me to say, hey, I have experience doing this stuff or um, or I learned something from here so I can take it with me just in case I do go into technology and art doesn't work out for me.

To achieve career goals, most girls realized they needed to keep good grades in school and got a college degree in the future. The evidence is quite consistent showing the career interests and pursuits of women are constricted by a sense of inefficacy for quantitative activities and skills necessary for occupations (Bandura, 2001). Girls realized they had challenges to expand these interests (e.g., personality does not fit in and not talented enough), they might give up and shift to other career goals. For instance, Elisa believed she did not have enough emotional capability to take care of animals and argue in the court for her customers. Since she had a

successful experience solving others' emotional problems, she shifted her interests from being a veterinarian and a lawyer to being a therapist. As she mentioned:

> I realized I'm not super good at arguing because I tend to get very emotional about it and start like crying or screaming or overreacting and I didn't want that to happen because that would be really bad in court, bad for like a client bad for me and I could end up helping someone that really doesn't deserve it.

Similar thing can be found in Savanna's case, she indicated that she was not good at science and math, which might prevent her getting into STEM careers. As she said, "I feel like I'm good at science, I understand science, but, um, math is, math is hard, math is hard for me. I'm not super good at math. I'm still learning to how to, you know, be able to, to figure things out on my own." Thus, the lacking of sufficient efficacy in competences might prevent girls from pursuing the careers which they are interested in.

In summary, this section presented that participating in the Girls in STEM program had influences on increasing girls' self-efficacy in STEM learning and communication, developing a sense of STEM identity, forming career interests in STEM fields. The study demonstrated STEM identity could be improved through the cooperative learning environment and more exposure to role models. Gender disparities have been shown in the study that not many of girls are choosing careers in science and technical fields. Although some girls developed interests in learning STEM, a STEM-related career may become their alternative choices. When it comes to their goals, girls needed to develop sufficient efficacy in supporting them to develop career pathways.

Discussion of the Findings

What specific characteristics of OST activities increase students' interest in STEM?

Making better use of potential learning time outside of school provides one approach to support and encourage females in learning STEM. Research indicated OST programs offered a structured learning opportunity and led to greater gains during the summer (Alexander, Entwisle, & Olson,

2001). Especially, summer learning is an important opportunity for at-risk students to gain academic growth (Steinthorsdottir et al., 2010). As Steinthorsdottir et al. (2010) mentioned, many OST program focus on underrepresented students groups, such as racial/ethnic minorities, females, and students from lower socioeconomic status backgrounds. Given the potential educational benefits, a significant issue remains: what specific characteristics of OST activities increase students' interest in STEM? Thus, in this study, I analyzed participants from Girls in STEM program and explored three important practices to cultivate girls' interest in STEM. I discussed the findings through 1) integration of different subjects, 2) opportunities for hands-on learning activities and collaborative work, and 3) conversational interactions with professionals

Integration with Different Subjects. Much research demonstrated that effective OST programs have a strong and focused academic curriculum to increase students' content knowledge and build essential skills (Alexander et al., 2001; Brown, 2008; Lauer et al., 2006; Morrow, 2006). To increase students' interests in STEM, the curriculum might include using hands-on science experiments as science learning methods (Becker & Park, 2011), computers and graphing calculators as mathematics learning tools (Morrow, 2006), programming as technology methods (English, 2017), and robotics as a way to learn engineering (Hinton, 2017; Leonard et al., 2016). These OST programs provide content that enriches learning, exposing students to new ideas (Alexander et al., 2001), and promotes a strong infusion of technology (Kandlhofer & Steinbauer, 2016).

As mentioned in Chapter 3, the integrated curriculum was applied in Girls in STEM program alongside project-based learning teaching approaches. Robotic and engineering were the main focus, while programming, gardening, nutrition, and art have been added into the summer camps since 2017. Hands-on activities, collaboration, small-group work, are highlighted

in the process of learning. This study found that integrating the interdisciplinary curriculum in OST program was beneficial for girls to learn more subjects. This findings confirmed the current literature that integrative methodologies of four fields improve students' interests and learning in the education of science, technology, engineering, and mathematics (Becker & Park, 2011).

Specifically, girls mentioned by having nutrition-related hands-on activities (e.g., making sushi, pizza, and muffin) in the camp, they were able to taste various food from different countries and experiment different aspects of Food Science. For example, Savanna mentioned:

> When I came the first time, it was still in the beginning of miniGirls. We didn't do a whole lot of programming. The curriculum is like more, um, I don't know, like, it's kind of perfected now. We didn't have nutrition and we didn't have the nutrition program the first summer I came, we always ate out. They [administrators in the program] would always bring people to or something catered. And I think it's helpful to have the nutrition part involved. 'Cause I mean it's, it's helpful to have different types of sciences. Um, not only just engineering.

While, Clara drew on a sushi and solar oven on her picture, showing her experiences of making food in the summer camp and doing a research project related to food science. She said:

> I drew Sushi because we learned like so much about food, like, food from other countries, not just here and it was healthy. But the Sushi kind of traumatized me. But that was still a great experience because I hate wasabi. It was so gross but I still loved making it. And then at the top here I drew the solar oven, which is going to be like, like a prediction of our solar of our solar cooker and how great it's going to turn out. And then we're making cookies now.

Students-centered instruction. The use of small-group work and hands-on learning is top of the list of successful teaching strategies (Steinthorsdottir et al., 2010). Small-group work emphasis on cooperation and communication is commonly applied in many OST program. In many STEM OST program, project-based learning has been widely used for students to connect the "school" knowledge to the real world and understand the importance of the contents to their lives, which in turn may raise their attitudes towards STEM subjects (Morrow, 2006; Wang & Frye, 2019). In Girls in STEM, necessary materials (e.g., robots and drones) were provided for

girls to work together. Communication and cooperation were two key components in the program and were required for each activity. By providing opportunities for cooperative learning, girls could utilize verbal and social skills to maximize the benefits of STEM program (Holba, 2015).

The results of this study showed the project-based learning promoted students' engagement and reflection. Hands-on activities are beneficial for students to practice skills and connect with real-world applications. While, working in small group, girls could exchange ideas and generate better solutions. For example, Ariana described how her team worked together and successfully improved the solution in a bridge building activity. She said:

> In the straws in the wood activity, she [a teammate] didn't really teach me but she made idea of cutting the straws in half and they just liked using the tape on like the bottom of the straw. So you can hold it as a table or something 'cause you're trying to make the bridge out of it. And they can be stable to put like, another layer and just like tip that around when you think that's a good idea. That actually works for me. Went to 1,000 to 500 pounds that it could way.

Thus, the active methods such as discussing and sharing ideas in small groups are critical for encouraging and accelerating interpersonal connections with new peers in an OST setting.

Interactions with high-quality and diverse staff. Well-trained and diverse staffs are a vital component of good OST programs (Miller, 2003) As suggested by Miller, staffs in OST program should know how to support the developmental growth of youth from a wide range of backgrounds. With diverse backgrounds, staff provide a range of types of female role models (Bouffard & Little, 2004). Similar as previous studies, this study found adults in Girls in STEM program interacted with girls in different ways and played various roles to provide better mentorships and assistantships. Girls, especially in the middle grades expected assistances and mentorship during the activities. Many cases showed getting support from staff could reduce students' stressfulness and overcome the challenges, while lacking of assistances reduced

students' interests in completing activities. For instance, Elisa revealed her dissatisfaction of one robotic activity, because it was disorganized. As she said:

> I kind of didn't like that [Geek Bus]. I didn't like that. It wasn't very, [pause], I do not know, it wasn't very interesting. They let us play with it for a while, but they were kind of just like, oh, you do this, you do that. I kind of want to, uh, what is it? Like, they gave me something and I just like, I have a base to work with and then I do everything. Like, I come up with it myself, not like you don't like me scripts of what you've already tried doing. That's what I didn't like that. They're like, okay, you have these lines you can't pass through, so how would you do it? I'm just kinda like, I don't know.

Furthermore, staffs from various background provided diverse career-oriented information. This information is vital to girls from underserved populations to develop career interests in particular fields (Brown, 2008). As shown in this study, girls expressed the presentations made from different people (e.g., guest speakers, visitors, and camp counselors) in the OST program broaden participants' minds in learning STEM concepts and making their career options keep open. For example, Felisa stated, "It [the program] really helped me, open lots of doors for me." Looking into details, she did not have any specific career goals in her mind, but she kept looking for different possibilities. The guest speakers in the program motivated her and pushed her to have higher expectations for her future. As she mentioned, "I would see myself in their positions or if I want to see myself in their positions. And I want to make like, a goal or something of what I want to do when I get older." As previous studies presented, many Title I funded schools are lacking of instructional materials and experienced teachers (Luebchow, 2009). The absence of opportunities and the educational gaps may prevent students from SEC backgrounds to get more career information and reach their full educational protentional (Young & Young, 2018). Therefore, enrichment through OST STEM program is essential to cultivate students' interests in various fields, especially for girls from SES backgrounds.

What are the barriers that prevent Latinas from participating in STEM fields? The gender gap in STEM fields has existed for many decades. Historically, due to gender bias and prevalent sexism within STEM culture, women have unequal opportunities to pursue an education in STEM fields (Hughes et al., 2013). Careers in science, math, and engineering are often viewed as masculine careers and not fitting within people's perceptions of feminine type work (Kager, 2015; Michael & Alsup, 2016). In recent years, although the number of women in science and engineering has grown, yet men continue to outnumber women, especially at the upper levels of these professions (Michael & Alsup, 2016). When it comes to career interest, females presented as less interested in STEM subjects and careers overall than males, especially for careers in engineering and technology fields (Michael & Alsup, 2016).

However, Bandura (1991) stated "perceived self-efficacy contributes to the valuation of activities," and "the intrinsic interest is better predicted by perceived self-efficacy rather than actual ability" (p. 258). Bandura explains the reasons why many girls lose interest in STEM even though they do not lack STEM abilities. Many girls lack the belief that they are capable of attaining STEM goals, which leads to decreased interest in pursuing STEM subjects and lower perceived self-efficacy in STEM careers (Bandura, 1999; Rittmayer & Beier, 2008). Thus, it is important to understand the barriers that prevent Latinas from participating in STEM, which may help increased their confidence, self-efficacy, and interests in STEM. In the following part, I demonstrated stereotypes of women in STEM and the influences of socioeconomic status as barriers that may prevent participants in continue taking STEM coursework and consider STEM careers.

Stereotype of women in STEM. Many girls in this study noticed that women are not dominant in STEM fields. People have stereotypes of women in STEM, and gender bias exit

many STEM fields. Some girls indicated that they experienced stereotyping by their peers when participating in STEM program from their peers. In school, some girls might have the misunderstandings about computer programming and the OST STEM program. They believed the summer camp is like another school. Others might have stereotypes that pursuing STEM career was such a nerd thing. As one girl mentioned, she wanted to change girls' opinion about learning science and programming was boring. She said:

> I want to change the way kids have a perspective on, on knowledge. They're like, oh my God, that's so boring. But like, what if they don't understand. Everything around us is knowledge, you know, like, the science and how this wall was made, their size and how that plant just grow. Like, everything that we are doing, they, that's science. It's knowledge and they, I think personally kids should be more interested in than that because they're growing up in a society of technology and science and a new generation driven perspective.

Furthermore, majority of participants in this study recognized the gender bias in STEM fields. As Felisa mentioned, being a scientist or an engineer could be a challenge for girls and even harder for women to reach higher positions in STEM-related fields. Amada also noticed the unbalanced female-male ratio, which might cause gender bias in the car fixing industry. But she wanted to prove to guys that girls were equally talented as guys and they were able to do stuff the same as guys, even though it might be a hard thing. As she said:

> I just kind of influenced myself to like, probably if I'm older I can probably get a job that works with cars or something. So that can probably be like a girl doing one and they can or if I can prove myself to them saying that girls are much as better as guys are too and girls can do stuff the same as guys.

Most girls believed people should not have any stereotypes toward female in STEM fields. To change the situation of women in STEM, Savanna was interested in choosing a career path which could break the stigma around genders, stereotypes, and STEM. From her perspective, she believed, "It's really great to, to be able to explore, um, different opportunities and different things and, um, yeah and I'm just kind of like breaking the stigma between genders

and things that anybody can do whatever they set their mind to do. So, people should not have any stereotypes toward any female in STEM fields" and "It was great to be a female scientist."

To address and misconceptions about STEM fields, many OST program specifically designed for girls with the intention to positively influence girls' self-efficacy and interests. At this point, the all-girls thought the learning environment in the Girls in STEM program was a great way for women who wants to get into higher education and involved in STEM fields in the future. The program had the educational purpose to tell all the girls that they could achieve high in STEM fields equal to boys. As mentioned by Amada:

> I am very excited about the camp because it has lots of girls basically…it's really good that they started doing an all-girls camp because um, they just want to get girls a chance to do something that they never really done before.

Socioeconomic status. The family as a collective environment has great impact on participants in this study. As revealed by participants, most of them have more than two siblings and most of their parents do not have college degrees. A few girls expressed they had responsibilities to take care of kids at home and be a role model for others. Felisa would think of anything that would help her family. She also needed and wanted any help that could assist her or her family in a good spot in the future.

This study confirmed previous studies that socioeconomic status limited Latina's options and affected their career development (Modi et al., 2012). Research demonstrated that low-income youth and less-educated families were less likely to participate in a range of OST activities (Bouffard et al., 2006). Parents' prior experiences also impacted the way that their children participated in OST programs.

As presented in this study, many girls desired to support their family financially. The data showed getting the scholarship for college could reduce parents' burden, which was one of their

concerns when they consider colleges. Getting good grades is a strategy to get scholarship and enter into college in the future. For example, Alyssa expressed that she preferred to attend the program which could provide financial assistance. As she said, working for NASA was one of her options because NASA could pay for full scholarship for everything. However, she might have difficulty to go to her favorite STEM-based charter high school, because of her family did not have a car. Thus, she had to choose a high school nearby her home. Additionally, in the case of Reya, she said:

> My family isn't really that um, rich like we don't have a lot of money but I'm gonna try and work hard so that way cause I know my grades now will affect how I, when I get into college and um, I want to get good grades so that way I can get into a good college. And that way I don't, my family doesn't have to worry about like, cause I know in some colleges you have to get accepted or you have to pay a bunch of money to them. And I don't really, I want to get accepted. I don't want my parents have the burden of just spending a lot of money in them being in debt. So I want to try and financially, yeah, I want to try and help them.

When it comes to career choices, most participants revealed that financial factors were not the major factor that affected their career interests, but they preferred to select the job with the good salary. Girls realized STEM-related job (e.g., civil engineering, therapist, and technology programmer) earned good pay, while people who graduated from art school could not really find good jobs in art. For example, Elisa expressed the reason why she was interested in being a therapist. Thus, it is an important for OST programs to attract more economically disadvantaged girls and pay particular attention to Latino groups. As she said:

> My parents say like they will support me no matter what they said, but they prefer if I do something that's good financially and they have agreed that this is good financially, the soul keep me well-endowed financially and they'll, they'll try and go to college. Therapists get a really good pay most of the time. And I mean I'd probably have to start off at lower rates, but I think they get around like $80,000 a year, like starting or something. So it is good financially because you can have more of a steady pay and you can find what fits you perfectly and like where you want to live better because you can control your own hours or you could work for a bigger company and help a ton of people.

Implication

What we can do to improve Latinas' STEM interests? The findings in this study demonstrated the program had influences on improving participants' self-efficacy, rising middle school girls' interests in math and sciences, and developing high school girls' career interests in STEM-related fields. However, what researchers and practitioners can do to persist and improve middle school and high school Latinas' STEM interests?

Having long-term STEM exposure is beneficial for middle school and high school girls to explore various subjects and develop their interests in STEM learning, as they are at the age where they have the desire to learn different things. Building a positive learning environment is essential to exchange students' perspectives and develop essential skills, which may effect on their self-efficacy, interests, and career development. The long-term exposure are especially needed for students who are underrepresented minorities in Title I schools. As these schools and social environments do not provide enough resources and positive supports for students to develop STEM skills and interests. As in many middle schools, engineering is not on the list of students' courses. Students barely develop engineering skills in the classroom. Some out-of-school programs integrated multi-disciplines and may help to supplement the learning that schools do not usually provide.

Furthermore, programmatic structure and ongoing emotional and learning support are essential to improving program outcomes. From the programmatic structure, the middle school OST STEM program could provide more fun and hands-on activities. The high school program, on the other hand, can emphasize the instructions and career exposures. It is important to note that middle school girls are in the transition from elementary school to middle school, where they are experiencing physical, mental, emotional and social changes. At this age, they are also

developing their self-identify and self-awareness. For instance, as shown in Figure 14, one girl mentioned she was carrying a lot of emotional baggage. She said:

> I just list things like, kind of make me stressed like, the drama at school. That's a bunch of drama going on right now. Um, math, my wellbeing, grades, um, me trying to relax my parents. Uh, the overwhelming feeling of death, the future. Um, what high school I'm going to, um, what am I doing carrying all of this and my friend's emotional baggage.

Thus, getting help from facilitators in the OST program would be beneficial for developing girls' social and emotional skills and maximize their academic learning. These facilitators can act as teachers who help explain the concepts, motivate students to learn, and raise students' interests in science and math. Lack of assistance in the process of learning may decrease students' motivation and efficacy, which also causes negative emotions. STEM OST programs may need to focus on "how much" support rather than the "how many" activities and knowledge they can cover.

Moreover, followed by the SCT and SCCT models, we can see middle schoolers and high schoolers' interests are related to many factors, such as self-efficacy, outcome expectations, and goals. In this study, Latinas' education and career choices are affected by their cultures and socioeconomic status. Most of girls realized the gender bias and stereotypes towards women in STEM. Thus, the coordination of social environments (e.g., school, family, and community) and the program could have better supported and facilitated girls in ways of persisting and developing interests in STEM-fields.

Figure 14. Emotional baggage.

Limitation of the Study

There were several limitations to the present study that related to the research design. A limitation of case study research is that the findings have the issues of generalizability to other cases similar to the case of focus and to the wider population. This study focuses on a single unit and selects multiple embedded cases which best present the entire case. I proceeded with the qualitative case study because I was interested in exploring students' learning experiences in the STEM OST program and the influences of the program on Latinas' self-efficacy, interests, and career development.

To create a better interview and cooperative research environment, I collected the data during the summer camps and conducted art-based activities and interviews in the separate classrooms. This time period may have affected the quality of the data that students expressed different moods during the interviews. For example, I conducted my first time interview with Elisa when she just finished her robotic competition. At that time, she felt frustrated and stressful, because she did not performance well in the robotic competition. On the other hand, in the art-based activities, girls sit in a round table and presented their pictures together. The cooperative environment may affect the quality of paintings and presentations. Some middle school girls were easily affected by others. They might follow others and feel shy to make a public presentation. While, if the atmosphere in the art-based activities was relaxed and happy, the whole group of students tended to say more than other groups.

There were several limitations that should be addressed and remedied in future research. The findings from this study are consistent with other studies about the STEM program as supportive and nurturing in increasing girls' self-efficacy and developing their interests. However, participants in this study are middle school and high school girls, whose interests and aspirations are not stable and do change after getting more experience and possibilities. There was less data in the study demonstrating the persistence in STEM fields. Future longitudinal studies could follow these participants after these they enter college or face career choices.

Conclusion

This qualitative study aimed to explore Latina's learning experience of participating in an OST STEM program in South Texas and the influences of the program on their interests, self-efficacy, and career development. The data from personal in-depth interviews and follow-up interviews included a total of 41 middle school and high school girls. The answers to the

research question that led this study, “What are the influences of participating in Girls in STEM on girls’ self-efficacy, interests, and career development?” were organized into three sections. The first section examined research questions, answering participation’s learning experience, presenting the application of theoretical framework, and showing the influences of the STEM program. In the second section, I discussed the characteristics of OST activities and barriers of Latina to pursue STEM. This study found three important characteristics of OST activities that increase Latinas’ interest in STEM, 1) integration with different subjects, 2) student centered instruction, and 3) interactions with high-quality and diverse staffs. The stereotypes of women in STEM and socioeconomic status were two barriers that prevent Latinas from participating in STEM fields. The last part provided suggestions for the future direction to persist and improve Latinas’ STEM interests. As I suggested, it is important for OST programs to provide a long-term exposure, build a positive learning environment, provide ongoing emotional and learning support, have diver mentors, and cooperate with school, family, and community in the program.

However, because participants in this study have not made any career decisions, new questions arose: “Can they persist in pursuing STEM when they entered into colleges or workplaces?,” What career-oriented information can we provide to inspire more young Latinas?” In order to answer these questions, further research studies need to be conducted.

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Appendices

Appendix A: Interview Protocol Part 1: Life and Culture Influences

Theoretical Framework	Structure of Interview Questions
Social Identity	• How do you and others think about being a Latino/female scientist or engineer?
Mastery experiences	• How do you believe your abilities and performance in middle school? • What negative or positive experiences have contributed to how confident you are in school classes? To what degree did these experiences affect your feelings about your abilities?
Vicarious experience/Social Persuasions/career development	• How have other people(Family/Teachers/Peers/Culture) influenced how you think you will do/are doing and your career choices? • What sort of sociocultural (Family/Teachers/Peers/Culture) messages did you get toward to your future development? • Please give examples of what types of supports you gained from Family/Teachers/Peers/Culture.
Physiological states/Social Persuasions	• What did people say to you as you were pursuing mathematics, science, engineering or technology?
Career Development	• When did you first form an opinion about your career? • Could you please list some jobs you may interested in or your career plans? Please explain or give an example. • Connect with the data from Art-based activity

Appendix B: Interview Protocol Part 2: Learning Experiences in OST STEM Program

Theoretical Framework	Structure of Interview Questions
Background	• years of camp experience, lists key activities in the camp
Social Identity	• How do you think about being an member in STEM program? What kind of group work affect your identities?
Mastery experiences	• Please describe a positive(success) or negative(failure) program experience that you feel shaped your feelings toward STEM. • To what degree did these experiences affect your feelings about your math/science/engineering/technology or others abilities?
Vicarious experience/Social Persuasions/	• How has the program and others in the program influenced how you think you will do/are doing and your career choices?
Social Persuasions	• What have other girls/ people in the program said to you that has affected your confidence in your study, especially related to STEM fields? Please give examples of what types of supports you gained from the program.
Career interest	• What participatory experiences contributed to pursue your career plan? Tell me about any experiences you had in the program that exposed you to the STEM careers. To what extent have the program affected your confidence in your study and career paths, especially related to STEM fields? • Did you ever consider working in a STEM field? If yes, what changed your mind? If not, why not?

Appendix C: Parents' Consent for Participation in a Dissertation Research

Research Title: The Influence of an Out-of-school Time STEM Program

Researcher: Chaoyi Wang

I allow my child(ren) to participate in a research project conducted by Chaoyi Wang from the University of the incarnate Word. I understand that the project is designed to gather information about the influences of miniGEMS program on middle school girls' self-efficacy, interests, and career development. My child(ren) will be one of approximately 10 people being studied for this research.

1. The participation in this project is voluntary. I understand that my child(ren) will not be paid for my participation. My child(ren) may withdraw and discontinue participation at any time without penalty. If I or my child decline to participate or withdraw from the study, no one will be told.
2. I understand that there are two kinds of research activities, art-based activities and three times interviews if needed. Most of the activities will find the discussion interesting and though-provoking. If my child(ren) feels uncomfortable in any way during the actives, I have the right to decline to answer any questions or to end the interview.
3. Participation involves being interviewed by a researcher from the University of the Incarnate Word. Each interview will last approximately 15-20 minutes. Notes will be written during the interview. An audio tape of the interview and subsequent dialogue will be make. If I or my child(ren) do not want to be taped, I will not be able to participate in the study.

4. I understand that the researcher will not identify me and my child(ren) by names in any reports using information obtained from this study, and that my and my child(ren)'s confidentiality as a participant in this study will remain secure.
5. I understand that this research study has been reviewed and approved by the Institutional Review Board (IRB) at the University of the Incarnate Word. For research problems or questions regarding subjects, the Institutional Review Board may be contacted with IRB contact person: Dr. Trinidad Marcias, trmacias@uiwtx.edu
6. I have read and understand the explanation provided to me. I have had all questions answered to my satisfaction, and I voluntarily agree my child(ren) to participate in this study.
7. I have been given a copy of this consent form.

_____ _____

My Signature Data

Appendix D: Invitation Email

Dear parents,

I am a PhD. Candidate in the University of the Incarnate Word. As part of my dissertation, I wish to carry out a research project to measure the influences of Girls in STEM program on Latinas' self-efficacy, interests, and career development. The findings of this study will provide applications for educators, researchers, teachers, program managers for future STEM program development. The results of the study will add the current research on Latino middle school girls' attitudes, interests, self-efficacy, and career development, especially towards STEM fields.

To carry out this research, I will be using a variety of data collection techniques. These will include audiotaping, observations, interviews, art-based activities. I guarantee confidentiality of information. I will only report information that is in the public domain and within the law. I will not reveal anything of a personal or comprising nature. There will also be total confidentiality of middle school girls', teachers', and parents' names. The overall duration the research will start at January 2019 to December 2019. I would be grateful for your permission and support your child to the study.

Chaoyi Wang

PhD. Candidate at the University of the Incarnate Word

Appendix E: Child's Consent Letter

Research Title: The Influence of an Out-of-school Time STEM Program

Researcher: Chaoyi Wang

I am doing a study to explore the influences of long-term learning experience in miniGEMS program and I need your help. I am going to do art-based activities with about ten miniGEMS participants to capture different participants' experiences in the program which may relates to the development of their self-efficacy, interests, and careers. I am also going to interview about ten miniGEMS participants and collect the details of program experiences and social influences on self-efficacy, interests, and career development.

If you agree to take part in my study, we'll do art-based activities that I'll audio record. I will ask you to create a picture about your career path, draw a metaphor of the program, and discuss with other participants. We'll also do three-interview series that I'll audio record. I'll ask you questions about your background, social identity, self-efficacy, career interest, and career development.

I will transcribe the art-based activities and interview, and then delete the audio files to protect your identity. And I'll digitally erase anything on your writing that might identify you. The transcript and your writing will be kept for up to 10 years for further analysis.

You can ask questions about this study at any time. If you feel uncomfortable in any way during the actives, you have the right to decline to answer any questions or to end the interview. If you decide at any time not to finish, you can ask us to stop. And if you do, I will delete our copies of

all of the transcripts and all of the writing you shared with us. And I won't share anything with others.

If you sign this paper, it means that you have read this and that you want to be in the study. If you don't want to be in the study, don't sign this paper. Being in the study is up to you, and no one will be upset if you don't sign this paper or if you change your mind later and decide not to participate.

Your signature: _____ Date _____

Your printed name: _____

Signature of person obtaining consent: _____Date _____

Printed name of person obtaining consent: Chaoyi Wang

Appendix F: Informed Consent Form

Subject Consent to Take Part in a Study of
The Influence of an Out-of-school Time STEM Program
University of the Incarnate Word

Authorized Study Personnel: **Chaoyi Wang, PhD Candidate in Education,**
UIW Dreeben School of Education
chwang2@student.uiwtx.edu

Key Information: Your consent is being sought for your child to participate in a research study. The purpose of the research is to explore the influences of participating in an OST STEM enrichment program on girls' interest, self-efficacy, and career development. If you agree that your child can participate in this study, the project will involve:

- Procedures will include two forms of research activities, art-based activities and interviews.
- In art-based activities, your child (participant) will encourage to create pictures/arts based on the research questions and explain the contents to other participants and the researcher. Your child will also involve in three times interviews. Each interview will last approximately 20 minutes. I, as a researcher will take notes and audio-record in all research activities.
- At least 3 number of visits are required
- These visits will take approximately 3 hours in total
- There is no physical risk in this study. It may have minor emotional risks if your child feels emotional when answering some of the questions.
- Your child will not be paid for your participation
- Your child's participation is voluntary and you may decide not to participate at any time

Invitation: You child is invited to volunteer as one of 10 subjects in the research project named above. The information in this form is meant to help you decide whether or not you child can participate. If you have any questions, please ask or send email to chwang2@student.uiwtx.edu

Why is your child being asked to be in this research study? Your child is being asked to be in this study because your child had been in the Girls in STEM program for more than one-year. I believe your child is suitable for this study and your child's experience can help me better understand the program within the research contents.

What is the reason for doing this research study? The purpose of this study is to explore the influences of the participation in an OST STEM program on middle school girls' self-efficacy, interest, and early stage career development, especially it emphasis on Latino population in South Texas.

What will be done during this research study? I will do an art-based activity first. I will ask your child to create some pictures/arts based on the research questions, then discuss with other participants. This activity may take about 2 hours. Then, I will conduct three-interview series. The first interview will focus on exploring the details of program experiences. The second interview will focus on understanding on the social, family, school, culture influences on self-efficacy and

career development. The third on will collect supplemental answers if necessary. Each interview will take about 20 minutes.

I would like to audio-record all activities to make sure that I remember accurately all the information your child provides. If you prefer not to be audio-recorded, your child will not be able to participate in the study.

I will keep these recordings and information in my personal computer with a password and personal cabinet with a code. I may quote your child's remarks in presentations or articles resulting from this work. A pseudonym will be used to protect your child's identity, unless you specifically request that your child be identified by her true name.

How will my data/samples/images be used? Your child's data (interview audio-record, art-based activity audio-record, any types of arts made in art-based activity) in this study could be used for future research studies. You are given the option to choose whether you will allow your child's deidentified data (audiotapes, any types of arts made in art-based activity) to be stored indefinitely for further analysis or other relevant research studies.

What are the possible risks of being in this study? (1) Your child may feel emotional when answering some of the questions. She may tell the interviewer at any time if she wishes to take a break or stop the interview. (2) As with all research, there is a chance that confidentiality of the information I collect from your child could be breached – I will take steps to minimize this risk, as discussed in more detail below in this form.

What are the possible benefits to other people? The findings of this study will provide applications for educators, researchers, teachers, program managers for future STEM program development. The results of the study will add the current research on Latino middle school girls' attitudes, interests, self-efficacy, and career development, especially towards STEM fields.

What will being in this research study cost you? There is no cost to your child to be in this research study.

Will you be compensated for being in this research study? Your child will not be paid for her participation in this research study.

How will information about you be protected? Everything I learn about your child in the study will be confidential. The only persons who will have access to your research records are the study personnel, the Institutional Review Board (IRB), and any other person, agency, or sponsor as required by law. If I publish with results of the study, you and your child will not be identified in any way unless you give explicit permission for this below.

For paper records, the data will be stored in a locked cabinet in the principal investigator's office and will only be seen by the researcher during the study and for 5 years after the study is complete.

For electronic records, the data will be stored electronically on a secure server and will only be seen by the researcher during the study and for 5 years after the study is complete.

What will happen if you decide not to be in this research study or decide to stop participating once you start? You can decide for your child not to be in this research study, or your child can stop being in this research study at any time, for any reason. Your child does not have to answer any question she does not want to answer. Deciding not to be in this research study or deciding to withdraw will not affect your and your child's relationships with the investigator or with the University of the Incarnate Word. Your child will not lose any benefits to which you are entitled. If you decide to withdraw your child from the study, the researchers will ask you if the information already collected from your child can be used.

What should you do if you have a problem or question during this research study? If you have a problem as a direct result of being in this study, you should immediately contact Chaoyi Wang, listed at the beginning of this consent form.

If you have any questions now, feel free to ask us. If you have additional questions about your rights or wish to report a problem that may be related to the study, please contact the University of the Incarnate Word Institutional Review Board office at 210-805-3036 or 210-805-3565.

Optional Study Elements

Consent for future use of data

Initial one of the following to indicate your choice:

_____I give permission for my child's deidentified (audiotapes, any types of arts made in art-based activity) to be used in the future for additional analysis or other relevant research studies. I understand that no additional informed consent for this use will be sought. I understand that my child's deidentified (audiotapes, any types of arts made in art-based activity) can be stored indefinitely.

_____I give my permission for my child's (audiotapes, any types of arts made in art-based activity) to be used for this research study only. I do not give permission for any future use beyond the scope of this research study. I understand that my child's (audiotapes, any types of arts made in art-based activity) will be destroyed within 5 years after completion of this study.

Consent for use of contact information to be contacted about participation in other studies

Initial one of the following to indicate your choice:

_____I agree to allow the researchers to use my contact information collected during this study to contact me and my child about participating in future research studies.

_____I do not agree to allow the researchers to use my contact information collected during this study to contact me about participating in future research studies.

Consent

Your signature indicates that you (1) consent your child to take part in this research study, (2) that you have read and understand the information given above, and (3) that the information above was

explained to you, and you have been given the chance to discuss it and ask questions. You will be given a copy of this consent form to keep.

_____
Name of Guardian

_____ _____
Signature of Guardian Date

_____
Name of Principal Investigator/Designee

_____ _____
Signature of Principal Investigator/Designee Date