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Autoethnography: A Self Reflection of the Benefits in Attending a T-STEM High School

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AUTOETHNOGRAPHY: A SELF REFLECTION OF THE BENEFITS IN ATTENDING A T-STEM HIGH SCHOOL

A Thesis

by

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ABSTRACT

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The purpose of this autoethnography is to analyze the benefits I obtained as a bilingual, first-generation, Hispanic student by attending a STEM high school. PSJA Thomas Jefferson T-STEM Early College High School provides an Early College experience as well as a Bilingual STEM environment in a district located at *La Frontera*. This autoethnography uses two techniques to collect data: artifacts and reflective journals. As the researcher, I self- reflected and analyzed my own success story which will be viewed through a Narrative Inquiry lens to answer two questions 1) to what extent has the STEM model/ curriculum influenced my academic achievement toward post-secondary education? and 2) What factors influenced me as a bilingual Hispanic first- generation college student to major in a STEM focus career path? Three major common themes emerged as result of the research; STEM model and early college environment, support systems, and language value all play a role in helping a Hispanic, bilingual, first generation college student to be college ready and pursue higher education.

Keywords: Bilingual, first – generation college student, STEM education, Hispanics, higher education

DEDICATION

This thesis is dedicated to the memory of my beloved grandmother, Martha Ordoñez, who passed away during my time in my master's program. My grandmother is the one who would always encourage me to work hard and never give up on my dreams and goals. One of my academic goals was to obtain my master's degree.

The completion of my thesis would have not been possible without the love and support of my family. My mother, Teresa Garza, my father, Jose Garza, my aunt, Martha, and my siblings, Edna, Jose, and Teresa. Thank you all for your constant motivation and help. I am blessed to have always counted on you. Thank you for your love and patience.

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CHAPTER I

INTRODUCTION

Demographics

La Frontera is a geographical region that connects the United States with Mexico. This border runs along California, Arizona, New Mexico, and Texas. Hence, a significant number of Hispanics make these states their home. These four states have a large Hispanic population, which is approximately one third or more of the United States population. According to the World Population Review in the year 2019, the Hispanic population of New Mexico consisted of 48.54% being ranked number one state with the largest percentage of Hispanics, followed by Texas with a 39.17 %, then California with 38.88 %, and lastly, Arizona with a total of 31.14% Hispanics. *La Frontera* is a place where a great percentage of the population primarily speaks Spanish at home and, for many students, also where they become the first in their family to obtain a post-secondary degree. According to McRobbie and Villegas (2004), most of the student population who live close to *La Frontera* are Hispanics. In all four states, in the area near the border, meaning within a 20-mile area, there is lower levels of education; students in this region are less likely to obtain at least a high school diploma (McRobbie and Villegas, 2004). In the Pharr-San Juan-Alamo (PSJA) school district located south of Texas within 20 miles from the United States and Mexican border, the story is different. This district has a large population of Hispanic students. In the academic school year of 2019-2020, PSJA served a total of 32, 438 students, with approximately 99 percent of them being Hispanic. Unfortunately, about 85% of

students in the PSJA district are economically disadvantaged; 73% at risk, and 41% are considered Limited English Proficient (LEP) (Pharr- San Juan – Alamo Independent School District, 2020).

In hope to increase student's education, PSJA high schools took the responsibility of providing students with an early college environment to help students in post-secondary education. As stated, their motto is "College Ready, College Connected and College Complete." The district is partnered with the local community college, South Texas College, with their goal being to increase the numbers of students pursuing a post-secondary education. With programs such as early college and dual enrollment, students are able to graduate college debt-free while simultaneously earning an associate degree. As suggested by Vargas (2014), "enrolling high school students in college courses has gained acceptance over the past decade as a strategy for increasing college readiness and success for a wide range of students, particularly those traditionally underrepresented in higher education" (p. 3). PSJA builds a drive to help students in communities where higher education completion rates are low by giving the students the opportunity to earn their high school diploma alongside an associate's degree or college credit.

Pharr-San Juan-Alamo Thomas Jefferson T-STEM (Texas Science, Technology, Engineering, and Mathematics) Early College High School, like mentioned in its name, is an early college high school as well as a T- STEM high school. A T-STEM school is essentially just a "STEM" school in the state of Texas. All T-STEM schools follow a blueprint, which consists of design elements where specified guidelines are to be followed by the school. The T-STEM blueprint has various components which are: school design, target population, strategic alliances, curriculum, instruction and assessment, work-based learning, and students support. Each component, also known as a benchmark, is thoroughly defined with a list of requirements T-

STEM academics should follow. For example, one benchmark of target population in T-STEM schools is to "identify, recruit and enroll the subpopulations of at-risk students" (Texas Education Agency, 2019, p.4). Additionally, T-STEM should also recruit and enroll students from underrepresented groups, such as first-generation college students and Hispanics. Another component from the T-STEM blueprint includes academic support for students such as tutoring and including time in students' schedules to prepare them for college readiness. The blueprint provided helps STEM schools maintain the integrity of their STEM model for a continued improvement of mathematics and science academics for their students. The main objective of T-STEM schools is to increase the number of students studying STEM related fields. Similarly, the mission at PSJA Thomas Jefferson T-STEM Early College High School is the following:

> Provide advanced educational opportunities with an emphasis on Science, Technology, Engineering, and Mathematics to all students so that they may graduate within a four-year period with an Associate Degree or college credit; thus, instilling the immediate desire for further post-secondary education to produce well-rounded community leaders. (PSJA T. Jefferson T-STEM Early College High School, 2020).

PSJA Thomas Jefferson T-STEM provides students with curriculums designed to prepare students for a STEM field, promote a college readiness environment, and encourage students to obtain a higher education.

Approximately 89 percent of the student body in PSJA ISD district's STEM schools' household income is below average (Pharr- San Juan- Alamo Independent School District, 2020). Most of the students attending STEM high schools are bilingual with their first language being Spanish, making English their second language. According to the U.S. Department of Education (2012), "Hispanic students are underrepresented in undergraduate and graduate STEM

programs and are not sufficiently exposed to STEM subjects at K-12 levels." The challenges many Hispanic student's face is reflected by the academic resources received. Many students lack information on STEM programs, which is a major factor that prevents many from majoring in STEM. Many Hispanic students come from low income communities and attend unequipped schools that receive unequal distribution of money, lack academic resources for students, and provide fewer opportunities to be part of advanced placement courses (Satz, 2007; Sharkwy, 2014).

Regardless of the challenges, some school districts have established STEM schools in low-income regions. These schools seek to promote higher education amongst underrepresented groups, such as minority and low socioeconomic students, by allowing students to be in dual credit college classes. Dual credit enrollment provides underrepresented groups to have access to free college classes at the high school level (Hoffman, 2005). This type of Early College program supports low-income communities since college courses are free. The science, technology, engineering, and mathematics (STEM), curriculum aims to promote and prepare the students to be college ready. Students are able to take Pre-Advanced placement classes, Advanced placement courses, and college career programs in STEM. According to Stringer et al. (2019), students who are part of extracurriculars related to STEM education like, robotics, Health Occupation Students Association (HOSA), computer science club, and Business Professional of America (BPA), for example, are encouraged to pursue a STEM major.

Nonetheless, while STEM education is at the national level, T-STEM is reserved for STEM academies within the state of Texas. According to Sahin et al. (2015), T-STEM schools have certain requirements and recommendations, outlined by a blueprint, that the academies should follow. The blueprint recommendation for T-STEM academies to grant course

opportunities in the areas of math and science to underrepresented groups such as the Hispanic population. As suggested by White (2014), STEM education at the local, state, and federal level is all intended to prepare students with critical thinking skills and challenge students to become creative problem solvers ready for the workforce. The STEM requirements intend to continue to provide advanced and quality education for such students interested in the STEM field. Sahin et al. (2015) argued that students who are part of a STEM school tend to achieve higher math and science scores in their state exam. For example, in the Texas Assessment of Knowledge and Skills (TAKS), STEM students scored higher than non-STEM students (Young, 2011).

Purposes of the Study

This autoethnography aims to describe the learning experience and the foundation a bilingual Hispanic first-generation college student received in a STEM, Early College, and Bilingual environment located in a school district in *La Frontera*. More specifically, a self-reflection and analysis of my own high school success story and the many influential factors that led to the achievement of higher education. I will voice my perspective as a high school STEM student. I will explore the supportive environment of a STEM high school and will analyze the impact of STEM education at a PSJA early college high school program provided to me as a Hispanic first-generation college student. This autoethnography will illustrate a reflective perspective of both myself and the STEM environment, as well as the factors which have left an impact in my academic journey. More specifically, the role a STEM education played in my obtaining of a higher education. As a first-generation bilingual student, most academic knowledge was gained through my second language, English. The autoethnography will show how in the STEM environment, using both the English and Spanish language can be used as a resource and advantage to learn STEM content. Based on my own academic experience, research

can give insight to school administrators, policy makers, and researchers who are searching for the creation of academic environments that will influence and help bilingual first-generation Hispanic students succeed and complete a college degree.

Research Question

As a PSJA ISD and T-STEM alumni, a T-STEM high school gave me the opportunity to participate in the Early college programs and STEM academies. As an underrepresented, Hispanic, first-generation college student who is from *La Frontera*, my chances of completing a college degree were relatively low. PSJA has provided the opportunity to enroll students in college courses as a strategy to prepare students for college and helps communities where the major population is Hispanic and speaks a second language, as supported by Vargas (2014). I have developed research questions focusing on the impact and benefits I had while attending PSJA T-STEM.

1. To what extent has the STEM model/ curriculum influenced my academic achievement towards post-secondary education?
2. What factors influenced me, as a bilingual, Hispanic, first- generation college student to major in a STEM focus career path?

Definitions

T-STEM: Texas- Science, Technology, Engineering, and Mathematics (T-STEM) are rigorous academies in secondary schools focus on improving instruction and academic performance in science and mathematics-related subjects and increasing the number of students who study and enter STEM careers (Texas Education Agency, 2019).

STEM: STEM stands for the career areas of Science, Technology, Engineering and Mathematics (White, 2014).

Bilingual Education: is an education method to teach two languages English and second language (Andersson & Boyer, 1970).

Dual language education (DLE): are programs where students are immersed with instruction in two languages and one language used at a time. As stated by Lindholm-Leary (2012), both language minority and language majority students are all placed in the same classroom with the objective to embrace high levels of bilingualism, biliteracy, academic achievement and culture competence.

Emergent Bilingual: refers to a student's ability to become bilingual, student's home language as a tool and resource to learn a second language, rather than a limitation to learn the English language (García & Kleifgen, 2010). The goal is to reach proficiency in both student's home language and in the English language.

First-generation: A college student who is the first family member to attend college and student's "parents' highest level of education is a high school diploma or less" (National Center for Education Statistics, 1998).

Hispanic: "Hispanics trace an [American] origin or descent from Spain or Mexico, Puerto Rico, Cuba, and many other Spanish-speaking countries of Latin America" (Census Bureau, 2020).

CHAPTER II

REVIEW OF LITERATURE

The United States, in past decades, has become a more diverse country. The percentages of minority students in the United States public education has increased. The Status and Trends in Education of Racial and Ethnic Groups (2018) demonstrates a growth in the Hispanic population between 2000 and 2017. This racial group has increased from 16 to 25 percent, making Hispanic students the second largest group. As a result of the increase in the Hispanic community, Hispanics are the largest minority group in the public-school system. *La frontera*, as mentioned before, is the region along the United States and Mexico border and, according to Brown and Lopez (2013), a large percent of Hispanic population resides within *La Frontera*. According to the U.S Census Bureau (2019), a total of 39.7% of the Texas population are Hispanics. Specifically, in the Southernmost Region of Texas, the Rio Grande Valley student's population, is mostly represented by the Hispanic/ Latino population, with a total of 96.94% (Region One Education Service Center, 2020). The county of Hidalgo, where the Pharr-San Juan-Alamo independent school district is located, and a majority of its population is Hispanic and speaks Spanish as their first language. According to The Texas Tribune (2019), at Pharr-San Juan- Alamo independent school district 44.8 % of the student population enrolls in a bilingual education. According to Census Bureau (2018), the majority of the community, 92.4 % to be exact, are Hispanics. Additionally, the most spoken language in the area is Spanish;

approximately 83.2% of the population speaks Spanish, with only 15.7 % of the population speaking English at home. In this region, the Spanish language obviously predominates.

An advice by García and Kleifgen (2010), dual language education is beneficial for bilingual students because it allows them to use their home language in order to further develop their academic language. Many students at PSJA T-STEM are part of the dual language program, as stated on the PSJA school website. The "Dual Language Enrichment Program" is designed to develop cognitive and academic skills through the development of bilingualism and biliteracy. Bilingual education involves the students to use two languages, English and Spanish, while at their T-STEM school.

According to Census Bureau (2019), the terms of education attainment, 87.7 % of Hispanics at the age of 25 or older have a high school degree. In the meanwhile, only 31.5 % of Hispanics in the United States obtain a bachelor's degree. In other words, one out of every three Hispanic in the country will complete a bachelor's degree or higher education by the age of 25 or older. At the state level approximately 80 % of Hispanics obtain a high school degree and 14.5% obtained a bachelor's degree or higher. At the local level, in cities like Pharr, San-Juan, and Alamo, high school degrees obtained by its population, which is mostly Hispanic, only about 63% of the population complete high school. Nonetheless, an estimate of 14% of the population in these three cities obtain a bachelor's degree. Similar many cities like Nogales in Arizona, El Paso in Texas, Laredo in Texas, Calexico in California, and Pharr in Texas have more than 80 % of their population as Hispanics and a range in these cities from 12.8- 24.7 % of the population obtain a bachelor's degree (Census Bureau (2019). From those Hispanic students who graduated with a college degree, according to the National Science Foundation (2017), STEM fields are no

as common among Hispanics. There is less than 24 % of Hispanic students earning degrees in Science, Engineering, Physical Science, Mathematics and Statistics.

There is lack of opportunities for Hispanic students to be in STEM schools. According to the Status and Trends in Education of Racial and Ethnic Groups (2018), Hispanic students stand among the lowest racial groups of students to earn Advanced Placement (AP) or International Baccalaureate (IB) in mathematics and science. In the subject of math, only about 12% of Hispanic students receive credit in an AP/IB. Many college students use AP credit towards their bachelor's degree (Evans, 2018). A high school longitudinal study in 2009 examined 9th graders' transcripts from both private and public schools to compare the courses in which these high school students had earned credit. The course credits earned by the students correspond to a year-long class. Students obtained credits in various subjects; mathematics, science, computer and information science, engineering and technology. The study compared the credits students earned based on their race. The STEM-related course included work in math, science, computer and information, engineering, and technology. Students who were White earned, on average, 3.7 more credits than the Hispanic students in the subject of math (Status and Trends in Education of Racial and Ethnic Groups, 2018). Similarly, the numbers of science credits earned by Asian and White students are also higher in comparison.

Pharr-San Juan-Alamo Thomas Jefferson T-STEM Early College High School (T-STEM PSJA ISD) is a model school in the STEM fields. The district of PSJA provides Hispanic students with the opportunity to be part of a STEM early college environment to better the education in the southmost region of *La Frontera*. According to the Texas Education Agency (T-STEM), academics are an educational program for secondary school students and academic instruction focuses on improving student's academic performance relating to STEM subjects.

STEM academics try to increase the percentage of students who seek a STEM career by offering free dual credit courses, increasing college readiness, and provide academic and social support to their students.

The literature presented in this chapter will review Science Technology Engineering and Mathematics education and bilingual education programs. The literature for STEM education, will focus on the impact a STEM environment has on students and will discuss effective teaching practices for STEM education. In addition, bilingual education programs will address the emergent bilingual students. The literature will focus on dual-language instruction, and the effective teaching approaches for the bilingual students. Dual language education seeks to develop a student's first language and enrich the second language to fully become bilingual and biliterate. Whereas STEM education encourages students to become critical thinkers and problem solvers. As suggested by Collier et al. (2016) "STEM subject matter must consistently seek activities to scaffold the content and support the language development of students" (p. 13). STEM itself is like learning a second language and using scaffolding teaching techniques will facilitate learning.

STEM Education

Science, Technology, Engineering, and Mathematics (STEM) education is important to students as it prepares them to develop skills such as problem-solving, critical thinking, learn how to collect data, and analyze as students evaluate evidence. A teaching approach for STEM education involves teaching concepts based on "real-world applications." According to the U.S Department of Education the skills students obtain with a STEM education will lead the United States of America for citizens and future leaders to understand and solve challenges in the country and the world. STEM has brought discoveries, has help transform technological

advances, and helps the economy with the innovation. (Committee on STEM Education of the National Science & Technology Council, 2018).

There is a great need for the U.S to increase the number of students who received STEM education. In December 2018, the U.S planned a federal strategy for the next five years, where the federal government continues to partner with stakeholders who were committed to encourage participants of STEM careers specifically women and underrepresented groups. Then federal strategy and the plan to increase STEM college degrees begins by giving students "high-quality STEM education and the United States will be the global leader in STEM literacy, innovation, and employment" (U.S Department of Education n.d). According to the Committee on STEM Education of the National Science & Technology Council (2018), there are three main goals which represent their visions for high-quality STEM education: build a strong foundation for STEM literacy, increase diversity, equity and inclusion in STEM, prepare the STEM workforce for the future. The importance of the three goals is to increase the involvement of the community on STEM education, for federal agencies to prioritize their funds in STEM education.

According to the Committee on STEM Education of the National Science & Technology Council (2018), all students, regardless of their zip code or racial identity, should have equal opportunities to be part of STEM education. Unfortunately, minority students are underrepresented in STEM education. The American educational system has failed to provide equality and adequate education for "poor children [who] are more likely attend crowded and poorly equipped school with less qualified teachers that children of more affluent families" (Satz, 2007). Minorities students experience unequal funds, including resources, and having unqualified teachers. Students in poverty need additional resources and the basic funds and resources are not being provided to pupils therefore, students need more emotional and academic

support. According to Satz (2007), “poor students carry higher “load” – poor health, developmental abilities, hinder, family disruption, and violence – which makes them more costly to educate” (p. 628).

There is no equity when it comes to providing quality education in STEM education to students who are African Americans, Hispanics, and American Indians because there is “disparity in the distribution of human, material, and financial resources” (Committee on STEM Education of the National Science & Technology Council, 2018). In addition, teacher preparation is another factor of inequality since Hispanic students many times are taught science or math by an “unqualified” teacher who majors in a different subject they teach. Additionally, Hispanics schools’ districts compared to schools that have predominantly White students have less funding and instructional resources (Nora & Crisp, 2012).

According to the National Science Foundation (2017), the most common fields of study for Hispanic students who obtained a bachelor’s degree in 2014 include Psychology (14.85 %) and Social Sciences (13.23 %). There are fewer Hispanics earning degrees in Science and Engineering, for example in the field of Engineering there is only (9.56%) of the student population majoring in the subject, in Physical Science (8.02%) and the number are even less when it comes to Mathematics and Statistics (7.90%). In the last 20 years, there has been an increase of Hispanics students who major in the fields of Science and Engineering. The percent of bachelor’s degrees in Science and Engineering reflect one form every six students is from an underrepresented group.

Educators in the STEM field and policymakers have various understandings of the concept of how STEM is taught. Many educators define STEM as a “purposeful integration of some or all the four disciplines” (Sahin et al., 2015, p. 11), meaning the content from science,

technology, engineering, and mathematicians can be combined to solve real-world problems. STEM education has become a priority due to its worldwide competitiveness. As mentioned by Sahin et al. (2015) STEM skills are the "key to success for all students in the 21st century and rising jobs" (p. 12). In order to increase STEM education, the federal government has invested billions. The money funded has helped improve STEM education by helping build statewide networks, specialized STEM schools, and providing STEM educators with professional development (Sahin et al., 2015). Moreover, the commitment to improve STEM education by creating STEM programs is a way to enhance STEM education in America (Sahin et al., 2015).

STEM Environment

Many studies support the idea that the educational environment influences a student's attitude and motivation towards certain subjects. For example, a research study used surveys to ask students about their views on STEM. "STEM Attitude Scale," "Scientific Creativity Scale," and "Motivation and Learning Strategies Scales" scales were used to determine how interest students were in the STEM fields. Additionally, written responses were received as part of the data collection. The purpose of Ugras (2018) was to determine if "STEM activities improved STEM attitudes" on seventh-grade students. Students were interviewed before and after they were part of science activities. To no surprise, there was a difference in students' creativity and motivation after engaging in science activities. Comparing the pre-test and post-test results, data demonstrates when students are exposed to STEM activities, their perspective over STEM changed. A total of 40% of the participants agreed that STEM education is instructive, a total of 36% believed STEM education is entertaining, 20% believed STEM activities help develop creativity, and 4% think STEM education is motivating. A common viewpoint shared among participants about STEM education is that before the STEM activities, students believed science

topics to be boring, “ find them hard and boring, but [then] realized that after the process that these boring subjects could be instructed in an entertaining way” (Ugras, 2018, p. 172). Some responses from the students demonstrate STEM topics can be learned in entertaining and accessible ways. Having the opportunity to participate in STEM activities helped students reconsider their perspective on what they believed to be boring topics, such as science, changing the students’ mindset on science, leading to seeing the topic in a new light. Students learned about the value that is STEM, and the knowledge that can be extracted from such topics. They also were able to recognize that all the information learned could be applied to their daily life by helping students think about the information from different perspectives. Similarly, Means et al. (2018) study suggests that the 9th-grade students who participated in the STEM activities during their middle school years were significantly much more interested in majoring in the STEM field.

First-generation students may know the importance of education. Nevertheless, they face challenges which affect Hispanic low-income bilingual students to major in a STEM degree. A solution to increase the low education percentages of first-generation students is to create “a more engaging curriculum that will meet the needs of diverse students' populations, produce multicultural college-going identities and develop a local partnership to enhance learning opportunities” (Pérez Huber et al., 2015, p. 6) by creating positive school environment. Furthermore, a rigorous program will prepare STEM first-generation students and will impact their academic careers.

Another research conducted by Heyman (2016), narrowed down the push and pull factors on why students in the pathway of the STEM field either stay in the major or change majors. According to Heyman's, STEM low-income urban immigrant emergent bilingual struggle with

economic problems, linguistic and other barriers that limit students to continue in the STEM field. For several STEM students in low-income urban areas who are immigrants and emergent bilinguals, STEM was challenging during their first years in college. Students who decided to change out of a STEM major were classified by Heyman as “switchers.” In contrast, those students who completed or planned on completing a STEM degree were classified as “persisters.” According to Heyman (2016), those STEM persisters “attended a slightly more selected school than switchers” (p. 220). In other words, the factors which influenced these “persisters” to complete a STEM degree suggests students who had been part of competitive programs obtained higher scores in standardized tests and high school.

STEM Effective Teaching Practices

Effective instruction practices for STEM education involves teaching STEM as language-based instruction, using scaffolding, using culturally relevant instruction and Funds of Knowledge. Collier et al. (2016) suggest that STEM instruction should be taught in using colloquial English using words and phrases a student is familiar with instead of using formal English language during instruction. Language-based instruction focuses on how language is used to help students learn a subject. Therefore, it is essential to provide students with language-based instruction. The use of scaffolding techniques helps make language relevant, which will help students understand STEM concepts. Examples of Scaffolding techniques include rephrasing word problems and adapting the texts on a STEM language that students are familiar with.

To ease the STEM learning, it is important to teach these subjects with culturally relevant topics that are of interest to students by engaging students with the knowledge they are familiar with and providing examples related to student's culture (Gonzalez & Moll, 2002). The concept

of Funds of Knowledge is defined as a "culturally developed bodies of knowledge and skills essential for household or individual functioning and well-being" (Moll et al., 1992, p. 133). The knowledge and skills learned at home can be used as a resource to teach science by relating common topics and by providing examples that will help students better understand a concept. Razfar & Nasir (2019), suggest the idea of repositioning emergent bilinguals' Funds of Knowledge to Science Funds. The term Science Funds is similar to Funds of Knowledge "non-school cultural practices that can be used to develop formal scientific knowledge, practices, and dispositions" (Razfar & Nasir, 2019, p. 226).

According to Moll et al. (1992) Funds of Knowledge refers to the knowledge learned at home. Funds of Knowledge helps make connections between the home knowledge and lived experience, making academic knowledge easy to comprehend. The purpose of Funds of Knowledge is to meet students' educational needs by making science content- related, and students can make connections with difficult concepts. Building background knowledge is the same idea of Funds of Knowledge, where students use their learning experiences to learn additional science content. Short (2017) defines building background knowledge as "links between the new concept and past learning and between concepts and students' personal experiences" (p. 4243). Both Funds of Knowledge and building background knowledge are a resource when included in-class instruction because it gives students a sense of belonging because the knowledge gained outside of school is valuable during class instruction. Mejia & Wilson- Lopez (2015), students using Funds of Knowledge during classroom instruction is a powerful learning tool because knowledge acquired at home and community is used for educational purposes. As suggested by Moll et al. (1992), it is crucial to include Funds of Knowledge as it will help students make significant connections between the knowledge students

already have and new content. In this case, Funds of Knowledge will help students make a connection between STEM and the real world.

The Impact of STEM Schools

The benefits of attending a STEM high school are it provides students the opportunity to experience real- world STEM related problems, helps make connections to STEM related jobs, influence students to consider STEM fields, and prepares students for higher science and mathematics course (Sahin et al., 2015). According to the U.S. Department of Education (2012), Hispanic students are underrepresented in the STEM areas. Several influencing factors which encourage students to be in the STEM field are academic experiences, cognitive factors, and social-cultural (Crisp & Nora, 2012). Students who are exposed to a STEM environment and take science and mathematics at elementary and high school level tend to be interested in pursuing a STEM career much more than those who were not exposed to the STEM field. Gainen (1995) suggests the idea of a student's academic performance is influenced by the school environment and the teaching strategies used to teach students. Cognitive factors also influence the decision of students to major in STEM. According to Crisp & Nora (2012), the concept of self-efficacy is another factor that could either encourage or discourage students from majoring in the STEM field. If a student believes they have a solid math or science foundation, they have a higher probability of majoring in STEM. Lastly, social-cultural factors like family, friends, and peers play an important role in encouraging students' interest in science and mathematics.

Furthermore, research by Craig et al. (2018) suggested that teachers also influence students to enroll in STEM programs and to continue in a STEM field. Two undergraduate and one graduate student were asked to share their personal stories and experiences about the short-term and long-term impact their teachers had on them as they stayed in the STEM fields. Both of

the participants were minorities and first-generation college students. Omid, a participant, had limited English skills and only took English as a second language for one semester to meet high school graduation requirements. The student expressed his opportunity to be in math and science AP classes. The student recognized his outstanding performance in mathematics and science skills that he acquired in his home country. The student was encouraged by his English Second Language (ESL) teacher to meet and practice his English with his peers. In addition, the student stayed after school for tutoring hours. His science teacher also saw potential in him and encouraged him to major in computer science and to apply to scholarship opportunities. Omid believes his high school teachers prepared him personally, socially, and academically to be in a STEM field. As a first-generation college student, this student took full advantage of the United States educational system and was influenced by his teacher to obtain a STEM degree.

Bilingual Education

Bilingual education involves using two languages to teach students. As defined by Andersson and Boyer (1970), bilingual education is "instruction in two languages and the use of those two languages as mediums of instruction for any part, or all of the school curriculum." This type of education includes students to be taught in two languages, students first language (L1) and students second language (L2), both languages are used in class instruction to teach subject content. Bilingual programs offer students the opportunity to be bilingual and biliterate simultaneously. As defined by García and Kleifgen (2010), being bilingual involves dominating two languages and being "able to continue to function in their home language as well as in English [student] new language" (p. 2). Bilingual education allows students to learn another language other than their native language. A bilingual education program also supports and develops students' home language (García & Woodley, 2015). Furthermore, minority groups

providing bilingual education programs suggest granting students with just and fair education by teaching two languages. Students' first language and a second language are being used to help students construct meaning.

Type of Bilingual Programs

Within bilingual education, there are various types of programs; transitional bilingual education, developmental bilingual education, and two-way bilingual education, also referred as dual language education. In general, these types of programs use students' home language to help students learn English and to help students become biliterate (Garcia & Kleifgen, 2010). Transitional bilingual education, which is referred to as an early exit bilingualism education program, at first uses a student's home language (L1) as a gateway to learn a second language. Once the student has acquired some English, the program focuses on helping students learn the English language (L2) by placing students in English-only classrooms. In this case, students are no longer exposed to a bilingual teaching environment. Pacific Policy Research Center (2010) claims a transitional bilingual program is more of a monolingual program since the second language develops more because, after one or two years, students are no longer taught in their first language. Similarly, there is also developmental bilingual education, which is referred to as late-exit bilingual education. Both students' first language is developed as well as students' English language acquisition. Compared to early-exit bilingual education, late-exit bilingual education has a student enrollment duration of five to six years. The goal in late-exit bilingual education is biliteracy and for students to become proficient in English. Lastly, two-way bilingual education supports fluency in both students' first language and their second language. The duration of the program is five to six years, where students are taught in both languages.

Additive and Subtractive Bilingual Education

Bilingual programs can either be part of subtractive or additive bilingual education. Flores and Beardsmore (2015) summarizes subtractive bilingual education as a program which "helps develop student proficiency in the dominant language of society, with little or no interest in the development of the home language" (p. 208). When terms of subtractive bilingual education are used, students become proficient in one language, the English language. Therefore, minimum interest is expressed on students' first language. On the other hand, additive bilingual education promotes equal competency development on both students' first and second language, in this case English and Spanish.

The language majority is the English language is learned and used to increase the privileged positions in society since these are the language skills people need to obtain jobs. In addition, to knowing a second language the set skills problem solving and critical thinking acquired from STEM education can also prepare them for the workforce. In contrast, language minority populations "are often the outcome of political struggles for autonomy and self-determination and serve as a tool of community empowerment" (Flores and Beardsmore, 2015, p. 205). In addition, many language minority populations may be separated and excluded from mainstream curriculum. Bilingual programs serve both language- majority and language- minority were student's cultural knowledge and home language are valued (Flores & Beardsmore, 2015).

Dual-Language Education

Dual language education (DLE) programs, also known as a two-way immersion, are instruction in two languages and one language taught at a time. As stated by Lindholm-Leary (2012), both language minority and language majority students are all placed in the same

classroom with the objective to embrace high levels of bilingualism, biliteracy, academic achievement and culture competence. Native English-speaking students and English Language Learners (ESL) both learned language from their peers. When it comes to Dual language education, there are various models 90:10 and 50:50 models. Depending on the model, certain time is spent on teaching in a specific language. For example, in a 90:10 model students are taught content instruction 90% in Spanish and the other 10 % of the instruction is in English. In the 50:50 model, instructional time is equally divided in two languages, like Spanish and English, for example. In immersion programs, students are involved in second language instruction between 50% and 100%. The main objective for these programs is to develop fluency and literacy for students in both languages (Cummins, 2009).

Effective Teaching Approach for Bilingual Students

Effective teaching instruction in bilingual immersion programs suggest students' educational time be respected depending on the dual-language model planned. According to Cummins (2009), it is recommended for students at the elementary school years for the instructional time to be at least 50% in the minority language. Additionally, the use of translanguaging allows students to go from one language to another because there are two languages within one language system; students can mix both languages. According to Zahner & Moschkovich (2011), using two languages will provide students with the opportunities to make meaning of words in both languages "using primary language vocabulary may be an effective way to facilitate vocabulary development in a new language" (p. 47). Allowing students to translanguage means that students can learn content in one language, and then they can transfer their knowledge to another knowledge. For example, in the 50% instructional model, the subject content learned in Spanish has also been learned in English, and the subject taught in English is

also learned in Spanish. Translanguaging helps students in STEM areas because whenever a student knows something in one language, they have also acquired the information in a second language.

According to Davis (2009) research study focuses on the factors that affect academic success for STEM Hispanic low-income, bilingual students. More specifically, the research aimed to determine success of bilingual students in a science class when class assignments were translated for bilingual students. The research focused on the impact translation has on a student when pursuing a higher degree and declaring a STEM major. The participants in the case study were three Hispanic students, administrators, teachers, and parents. Two of the Hispanic students were English second language learners, while the other student had mastered the English language. Data collection was based on class observations, interviews, and translation of assignments. Assignments were translated from English to Spanish, the students' first language. Research supported English Language Learners (ELLs) agreed that language was a challenge in the science class. However, they became interested in the science field when assignments and textbook were translated. Despite ELL student's grades in biology class, they still wanted to major in science at their local community college. Lastly, the third student in this research was proficient in the English language. Parents had an education in the STEM field and encouraged him to complete a STEM field degree. As described by Davis (2009) several factors which influenced students to major in STEM careers included family support, English Second Language program implementation, and the usage of translation in science class.

Summary

As the numbers in Hispanic students continue to increase, Hispanics being the largest minority group, the need for STEM opportunities for Hispanics students only increases. STEM

education is important as it prepares students for the workforce and real world by helping them develop skills like problem-solving, critical thinking, and learning how to collect and analyze information in general. In regions with a high percentage of Hispanic students, education attainment levels are among the lowest in the nation. However, STEM academies like T-STEM PSJA ISD focus on improving student's academic performance by providing STEM related instruction subjects where Hispanic, first-generation students can experience a STEM environment and early college. First-generation students can greatly benefit from receiving STEM education since when they go to college, they are college ready. In addition to this, if STEM schools take advantage of students' bilingualism, language becomes a tool that helps facilitate the learning of STEM content. Collier et al. (2016) recommends using student's first language in content areas like STEM in order to facilitate learning for bilingual students. The best teaching practices to approach the learning of the science and math subject areas for bilingual students includes the usage of both languages to help students make sense of these subject areas and take full use of the students' capabilities. Overall, both the STEM environment and language support an important role when promoting STEM education to Hispanic, first generation college students.

CHAPTER III

METHODOLOGY

This chapter presents the methodology used in this research study. To gain an understanding on the topic of bilingual, Hispanic, first generation college student in a STEM environment, a qualitative approach was used. Gay, Mills & Airasian (2014) defined qualitative research, as the "collection, analysis and interpretation of comprehensive narrative" (p. 576). An autoethnography is a form of qualitative research. Through this study I am seeking to present and understand how the STEM environment has impacted me, a first-generation, bilingual, Hispanic college student, to pursue higher education. A series of artifacts and reflective journals will be used as part of the data collection. According to Pérez Huber et al. (2015), a total of 11 % of Mexican students will obtain a bachelor's degree and 3 % obtain a graduate degree. However, because of the STEM environment and bilingual skills, I was able to be the first in my family to receive a college degree. This thesis project will tell a personal story about my high school years at a STEM high school and answer the two research questions about the benefits of attending a STEM high school for a bilingual Hispanic first-generation college student.

1. To what extent has the STEM model/ curriculum influenced my academic achievement toward post-secondary education?
2. What factors influenced me as a bilingual Hispanic first- generation college student to major in a STEM focus career path?

Research Design

The research design for this autoethnography is qualitative. As defined by Gay et al. (2014), qualitative data focuses on nonnumerical facts. For example, data are collected through narrative descriptions or with visuals. An autoethnography is a form of qualitative research in which a researcher conducts research, collects and analyses data based on their personal experience. As suggested by Gay et al. (2014), this autoethnography will use self-reflective journals and artifacts as a technique to "collect stories as data" (p. 356). The self- reflection journals will state observations made from my high school material, thoughts, and insight on assignments throughout my high school years. A self-reflective journal will be kept with personal stories, memories, and perspective while going through the T-STEM model as a former T-STEM student. The artifacts include essays, projects and an autobiography will describe my academic and language experience and will be considered to explain primary factors that have helped me as a bilingual, Hispanic, first-generation college student complete an associate degree in the STEM field and continue to post-secondary education. The data will reflect on the STEM model 5 years post-graduation to identify what the T-STEM model "did right" to get me where I am now, at a master's level.

To analyze the impact the STEM environment had on my own academic success as a bilingual, first-generation student to pursue higher education in the STEM field, requires a conceptual framework which reflects my success stories through the lens of Narrative Inquiry. Narrative inquiry is used to capture individuals' experiences over time and to account for the relationship between personal experience and cultural context (Craig et al., 2018). In this study, narrative research will be used to further investigate my high school experiences, story, and identity by understanding how these perceptions have influenced me to major in STEM,

seeing as how my personal educational experiences greatly impacted my decision to be a STEM major. According to Craig (2018), current experiences can influence future experience and decisions. A student' "experiences cumulatively shape how students live, how they learn, and ultimately, who they are" (p.339). Personal academic experience will impact their perspective on STEM areas. Similarly, personal narrative stories can be related to the experiences received both positively or negatively and can influence students' academic trajectory.

Context of the Study

The autoethnography focuses on my personal experience on being part of the Texas model of the STEM schools. The state of Texas follows its own blueprint; while other states follow their own standards of STEM education. This study takes place at a Texas T-STEM school located in *La Frontera*. A T-STEM school seeks to enroll students who are at risk and who are economically disadvantaged, as supported by Texas Education Agency. The standards and principles provided by the Texas Education Agency must follow the blueprint before they serve a student like me.

PSJA T-STEM, the school used in this study takes place, stands out amongst the rest because it allows its students to earn two years of college while simultaneously obtaining their high school degree. At the time of the application, I remember being worried about not getting accepted due to the fact that, in my opinion, my application essays were weak due to my "below-average" English and writing skills. The selection process for attending T-STEM was based on the application essay and school grades. To my surprise, I was one of the lucky 110 incoming freshmen who were admitted based on their academic achievements. My class was supposed to initially have around 150 students. However, only about 110 applied, thus, we all got immediate admission.

Participant

As a first-generation Hispanic bilingual, I majored in STEM during high school years, more specifically, Chemistry. I chose to research about myself because I am a bilingual student who attended a STEM high schools and Spanish is my first language. During my early adolescent years, I struggled in English reading and writing. Language was a learning barrier and I was below average in reading. Until my high school years, I understood my poor literacy skills were due to lack of resources and socioeconomics. While completing my master's program in bilingual education, I became aware of how language plays into learning new content and decided to focus on STEM and language. This autoethnography seeks to present my story of the benefits of attending a STEM high school. My perspective on the STEM environment is crucial to fully understand the academic standards a STEM school gives its students.

Data Collection

According to Ellis (2000), as previously mentioned, an autoethnography is "an auto biological genre of writing and research that displays multiple layers of consciousness, connecting personal to the cultural" (p. 39). In other words, autoethnographies study and analyze self-data. For instance, it may include personal stories, dialogue, and emotions that create a deeper meaning to a culture experience. In this case, reflective journals will examine how the STEM environment has influenced me and my academic achievements in post-secondary education. Data collected artifacts, and reflective journals are used to understand the STEM benefits I received as a bilingual first-generation student by attending a STEM high school. As mentioned by Ortlipp (2008), reflective journals are used to "create transparency" to provide data that can be analyzed to address. Even further, they will help to identify what factors influenced me to be interested in a STEM focused career at the high school level. The data collection

includes: (1) a self-reflective journal: about my high school experiences including stories that describe the T-STEM environment, the college classes experience and my perspective on my high school assignments, my perspective about T-STEM high school as a former student, and my reflection on recent conversations with high school friends; (2) artifacts: (a) essays: scholarship essays about my academic success and academic failure, my best and worst subjects, career goals essay, self-concept essay of how I viewed myself as a 10th grader ; (b) projects: capstone research project, a 10 page research paper where I conducted research, chemistry lab reports, and the exams; and (c) autobiography: a project in which I wrote about my childhood years, my high school experience and my future for college.

Analyze Data

An autoethnography is a type of narrative research study. As defined by Gay et al. (2014) a narrative research is how different individuals experience the world around them. This method involves the telling of stories. As stated by Gay et al. (2014), key characteristics of narrative research, or in this case an autoethnography, consist of "restorying," also known as the process of collecting stories and analyzing key elements, telling a lived, experienced explanation of the story being told, and narratives constructed to answer research questions. The analysis of the narrative consists of the process of first obtaining data collected through reflective journals and artifacts which contain stories of my own high school experiences. Artifacts like the projects, class assignments and essays will be used to help accuracy in detail to include in the reflective journals. As mentioned by Gay et al. (2014) analysis of narrative stories, in this case the reflective journals and artifacts, will be analyzed by "common themes to produce a description that applies to all stories captured in the narratives" (p. 356). After gathering data, it is important to construct meaning from the narrative written by focusing "on particular knowledge about how

the outcome occurred… and the search for themes to develop general knowledge about the collection of [data]" (Gay et al., 2014, p. 356).

Autoethnography Validity

Autoethnography many times is criticized for not following the scientific standards. Research is considered "insufficiently rigorous, theoretical, and analytical and too aesthetic, emotional, and therapeutic" (Ellis et al., 2011, p. 283). The data are viewed as biased facts because research is not scientific enough. However, autoethnographies' narrative is based on personal experience; narratives are based on memory of the events lived. Individuals' perspective as they tell a story is different from others. All of this leads to finding how reliability and validity play a role in an autoethnography, "reliability refers to narratives credibility" (Ellis et al., 2011, p. 282). This data are credible because the autoethnography is able to collect data, also seen as evidence, that will help back up the narrative. In terms of validity, it involves stories to be described as true, believable, and realistic in order for the story to be coherent. Additionally, generalizability is significant because it gives the reader a viewpoint on the author's personal experience. Many readers may relate and make sense to the story and interpretation of data. As mentioned by Ellis et al. (2011) a reader is able to connect and understand new unknown knowledge on the topic, "readers provide validation by comparing their lives to ours, by thinking about how our lives are similar and different and the reasons why, and by feeling that the stories have informed them about unfamiliar people or lives" (p. 283).

Summary

This chapter discussed the method used in this autoethnography. This research will collect data in two main forms; in self-reflective journals and artifacts that help answer and

understand the benefits of attending a STEM high school. Both reflective journals and artifacts will be gathered for evidence to answer the research question. Data will be analyzed based on common themes presented throughout the data collected.

CHAPTER IV

FINDING AND DISCUSSION

This autoethnography is a self-reflection of my high school experience as a bilingual, Hispanic first- generation student attending a STEM environment. In chapter IV I will discuss the findings from the reflective journals and artifacts collected. The objective of the thesis is to analyze and emphasize the benefits of attending a STEM high school which, in this case, is Pharr-San Juan-Alamo Thomas Jefferson T-STEM Early College High School. In this autoethnography, I used the data collected to answer two major questions, a) To what extent has the STEM model/environment influenced my academic achievements towards my post-secondary education? and b) What factors influenced a student like me to major in a STEM focus career path?

Based on the analysis of the data, three major themes emerged. The first major theme involves the STEM model and early college environment. Second major theme is the support system received from teachers, friends, and family. Finally, the third theme presented in this autoethnography is language, seeing as it plays an important role in academic achievement college readiness.

The STEM Model & Early College Environment

PSJA Thomas Jefferson Early College High School promotes college readiness through a high school degree plan along with a STEM degree plan including an associate's degree. During

my time at T-STEM, I earned a total of 60 college credits, 42 credit academic core classes, and18 credits in a specific field of study, which, in my case, were chemistry. For my core credits, I took classes like music appreciation, sociology, computer science, professional communication, English, and history. For the 18 credits needed for my chemistry degree I took general chemistry I and II, biology I and II, and organic chemistry. Many of the high school courses I was enrolled in were dual credit, which meant I received credit for both high school and college courses. However, there were several classes that were not offered at T-STEM, so I had to attend South Texas College, a community college located in *La Frontera*, and take classes on campus. The classes I took on campus were Texas government, general chemistry, and organic chemistry. Attending a STEM high school and taking classes at community college exposed me to a real college environment and prepared me for higher education since I was now becoming familiarized with a college culture. The STEM early college environment was a positive experience because of the high expectations set for me to complete an associate's degree by my senior year.

Most of the classes I took in high school counted as dual credit, which meant classes were taught at a college level. As supported by Duncheon (2020), for students who attend early college and complete an associate's degree it "is assumed to represent the accumulation of skills and expertise" where skills and expertise refer to what could be later applied in higher education and in the workforce. As reflected in my data, the artifact provided an exam for my 1411 general chemistry class where I scored an 85, as opposed to my lab reports where I would normally score higher than a 90. As supported by my artifact, my lab report #3, an experiment on density, I scored a 92. My chemistry exam score was a result of my time management and the time dedicated to study (A. Garza, personal artifact- projects, June, 2013). The benefits of attending

an early college high school involve the following skills: time management, motivation, and study tactics.

Chlup (2018), mentioned being part of an early college program helps students adapt to a college environment. Part of this adaptation implies being responsible for one's own learning and gaining of independence. In other words, a "reality check." This phrase is used to express what college students go through when they become responsible for their own learning. In my case, the classes I took on the South Texas College campus were my "reality check;" since those courses challenged me to adapt to a real college setting where I was in a class with actual college students who were not part of an early college high program.

According to Sáenz & Combs (2015), the impact of attending an early college high school involves helping minority and first-generation college students. Sáenz & Combs (2015) research reinforces the importance of a positive school environment at Early college high school. In addition, to students becoming aware of the importance of earning an associate degree, a student's family should, ideally, positively contribute and encourage early college high school due to the financial advantages that are presented to students who receive an associate degree. Such students who value and understand the importance of earning an associate degree at the high school level will, more than likely, have an increased self-esteem and gain more confidence. Students will also develop skills that help them set goals and be good decision-makers. As reflected in one of my GMS essays, during my high school years I stated two major academic goals. The first goal was to "graduate from Texas A&M College Station" and my second goal was to "obtain my Ph.D. to do research" (A. Garza, personal artifact- scholarship essay, January 15, 2015). Even as a high school student, I knew these were feasible goals and that these were goals I could realistically achieve, all with hard work, of course. Coming from a low economic

region, my main concern while deciding where to attend was funding. My final decision to attend Texas A&M was based on the financial aid support I received.

As claimed by Perez Huber et al. (2015), closing the gap of underrepresented students involves providing students with a rigorous academic curriculum and college-going culture. By attending T-STEM, I was exposed to a rigorous program that involved me to take science or engineering related electives. Additionally, to a T-STEM environment and the early college culture, by attending South Texas College and taking college classes on the college campus, I was part of a high school education program which had high expectations when compared to your average high school. As a high school student, I was taking college classes, the classes at South Texas College consisted of students who were older. Multiple times I was the youngest in the class and I no longer had a class with all my high school classmates, I was now on my own. I was 15 years old and taking a Texas government class with students who were already in their 20s and 30s. As reflected in my reflective journal, "My Texas government class was different, like [I] no longer had a high school professor who was teaching the course, which meant the classes would be harder" (A. Garza, personal reflective journal- sophomore year, April 6, 2020) Taking courses at South Texas College campus challenged me to be a college student since I was expected to meet the college expectations. South Texas College classes were hard because professors now taught at a higher level. At the time, I was still learning to adapt to the college environment. Attending STEM and being in an early college exposed me to a real college environment and prepared me for higher education because I was now becoming familiarized with a college culture. The STEM early college environment was a positive experience because of the high expectations set for me to complete an associate's degree by my senior year. A majority of the classes I took in high school counted as dual credit, which meant classes were

taught at a college level. According to Allen & Dadgar (2012), taking one or more college classes in high school has a positive impact toward students. One major benefit of dual enrollment is the college credit earned and "participation in dual enrollment was positively related to enrollment in college" (p. 12). Subsequently, dual enrollment students will obtain a higher-grade point average than those who did not participate in dual enrollment and will most likely persist to continue with their education.

Being part of the STEM and early college environment encouraged me to look at my degree plan and consider if a certain class would count towards my degree plan. As early as my high school years, I was aware of my college degree plan. I knew the importance of summer classes and how they took part to complete my associate degree. My degree plan was set up to take summer classes to receive credit and be on track in order to meet the 60 hours needed for the associate degree. Nonetheless, in order to take college classes and receive college credits, I needed to pass all the sections of the Texas Success Initiative Assessment (TSI). In other words, I had to pass the mathematics, reading, and writing sections of the exam. These exams determine if one is ready to take a college class. Part of the STEM curriculum included attending a summer bridge program where, as an incoming freshman, I attended a three-day program and my teachers introduced and informed me about the college expectations. In this summer program, I took the TSI as an incoming high school freshman and I only passed the reading section. I managed to pass the reading comprehension section by merely one point and was unable to pass the math section. As a matter of fact, the first few times I took this assessment it had a different name, the test was called Texas Higher Education Assessment (THEA). In one of my journal's reflections I wrote,

> I remember taking three sections of the THEA; math, reading, and writing. I thought I had done [well] in the math portion since it was my strongest subject. Surprisingly, I failed [the math] portion of the exam while I passed the reading comprehension portion. The reading stories were not easy, but from the little understanding I had I could infer what the stories were about and was, fortunately, able to obtain enough points to meet the passing score. (A. Garza, personal reflective journal- freshman year, April 5, 2020)

Passing at least one of the reading or writing sections in the TSI assessment meant I qualified to participate in a college class. As stated in my journal as a freshman in high school, "I took my first college class ever. Music appreciation, an elective that would count towards any Associate degree." (A. Garza, personal reflective journal- freshman year, April 5, 2020). After this class, I started taking many other college classes, gradually, these classes started to become more challenging. In the summer after my freshman year, I only registered for one class, sociology. Sociology was the first class I took on the South Texas College campus, for me it was important to finish my freshman year on a strong note and enter my sophomore year with at least several college credits. A piece from my reflection states how important it was for me to take college classes during the summer. "Taking summer classes in the summer increased the probability of completing [my] associate degree" (A. Garza, personal reflective journal- sophomore year, April 6, 2020). As an early college and first-generation college student, I deeply understood the importance of an associate degree. The opportunity of taking a college class was not taken for granted.

Support System

Another major theme repeated based on the STEM environment high school experience is the support system provided during high school years. By giving a student a group of people

who can guide and help one go through schooling, is the key to a good support system which will contribute to one's academic achievement during high school and post-secondary education. In my case, my support system consisted of three groups: teachers, friends, and family.

Teachers

As stated by Calhoun (2019), it is important for students to build relationships with teachers, as these relationships bring academic improvement and increase student achievements. The opportunity of building relationships with their teachers can be utilized as an advantage. As suggested by Duncheon (2020), research claims academic support by faculty and staff at an early college high school helped students become familiar with the college environment.

T-STEM is a small campus that enrolls approximately 100-150 students and every academic school year there were approximately 30 teachers. T-STEM was such a small school that teachers and students were all one team. Teachers provide support, encouragement, and mentorship to students. All faculty members worked towards one goal to help their students get a post-secondary degree.

Teachers at T-STEM knew exactly how to help me and how to give me the appropriate guidance, which led me to a successful post-secondary education. The expectations these teachers instilled in me is what has kept me motivated, focused, and passionate about my education. Small talks, tutoring sessions, and mentorship were the foundations to build a relationship with them and receiving help at a more advanced and personal level. These teachers helped me improve my English skills, became my college advisors, and gave academic confidence.

As an 11th grader I took English III AP with Ms. Rodriguez, who was everyone's English III teacher, however, those who had passed the TSI were enrolled in the English III AP dual credit section. As stated in my reflective journals, "Professor Rodriguez had the same expectations for all her students, and she treated all her students like college students. Ms. Rodriguez's standards had always been high, she always motivated me with encouragement and affirmations to meet them" (A. Garza, personal reflective journal- junior year, April 12, 2020). I remember asking her for help to improve my English and her staying after school to tutor me. During these sessions she would explain various types of writing, revise my essays, breakdown topics to critically think about for the novels read in class. Her guidance and advise helped me pass the TSI exam reading section. I remember her saying "write as much as you can and make sure it all makes sense" (A. Garza, personal reflective journal- junior year, April 12, 2020). Ms. Rodriguez's support helped me go from failing to passing the TSI writing portion. I went from not passing my TSI to being TSI complete. Being TSI complete meant I could take college courses like English III AP dual credit. My writing level increased to a college ready level and I, additionally, learned to communicate fluently in English.

As supported by Craig et al. (2018), teachers also play an important role when encouraging students to achieve a higher education in the sense of applying to a certain field of study, practice the language and applying to scholarships by taking full advantage of the academic opportunities. The support received by my teachers during my senior year mapped the steps I needed to take to get the funds for my post-secondary education at the university of my choice.

In one of my artifacts, my scholarship essays I mentioned how "Texas A & M was the school I always wanted to attend while UTRGV was my backup plan" (A. Garza, personal artifact- scholarship essay, January 15, 2015). As a first-generation bilingual student, I was unfamiliar with the process of applying to colleges and as an English second language learner it was difficult for me to write essays in general, let alone for scholarships and college application. With the help of Mrs. Guillen, I learned how to do an Apply Texas application, complete and submit college applications, request transcripts to be sent to the universities I was applying, submit proof of immunization record, apply for [Government] Financial aid, and Scholarships. I remember Mrs. Perez, my English IV teacher sitting down with me to help me revise and provided some feedback on my college and scholarship essays" (A. Garza, personal reflective journal- senior year, April 13, 2020).

Mrs. Perez believed I could be a recipient of the Gates Millennium Scholarship, a prestigious scholarship. She realized my English essays needed organization, structure, and more importantly, my English grammar had to be revised. She helped me communicate my ideas into paper and write with good grammar. The support system received from the teachers from T-STEM improved my English, made me college ready, and increased my self-esteem. These teachers held me accountable for my own progress and always challenged me to go the extra mile for my education. My teacher strongly believed in the concept of self-efficiency (Crisp & Nora, 2012). My teachers believed in my academic ability to apply to any scholarship and even top universities. My support system gave me the empowerment I needed to prepare me for my career by gaining academic self-confidence. I applied to the Gates millennium scholarship and became a finalist. Obtaining this scholarship implied being academically funded for ten academic years in any field of study of my choice.

Friends

Sáenz & Combs (2015) stated how students at ECHS ask for help when it comes to homework assignments, applying to scholarships, and advice from their friends and teachers. The positive environment at ECHS related to the small campus of less than 500 students which created a "family- like atmosphere with caring peers and adults" (p. 112).

Friendships formed at school are one of the benefits of participating in an Early college high school, students in an early college high school rely on and support each other by forming study groups and encouraging each other. Students "establish relationships with peers who understand their goals and create cohorts to ease their burdens" (Calhoun, 2019, p. 318). Students in the early college face similar challenges such as being placed in unfamiliar and challenging environments where, as a result, they identify with each other and help their peers. I was friends with students who had similar goals and understood the importance of building a supportive group. Unity among my friends was formed to support each other.

My friends who were chemistry majors were united because we shared one goal. We all wanted to pass our classes and obtain our associates degree. The amount of time spent together is what further united us. There was good communication among us, and we were all interested in helping each other, it was mutual help. I helped my friends, and they helped me when they could. As reflected in my journal,

> T-STEM was like a family where we cared for each other. My friends and I study in groups and help each other in whatever we could, we gave each other rides to extra credit sessions, we studied together and crammed information right before the exam. We gave each other feedback on the lab reports and advice on the lab's assignments, we booked

study rooms at the library and attended tutoring together. (A. Garza, personal reflective journal- senior year, April 15, 2020)

There was so much unity among the Chemistry majors. We cared for each other because we all shared the goal of obtaining an associate in one of the hardest subjects. There were not many chemistry majors and the last thing we wanted was for one of us to change majors. In any free time, we had, we would explain and study the science material, "I remember explaining math or chemistry problems to my friends, and they explained to me the concepts I didn't understand. We tutored each other, during our lunch break and breakfast" (A. Garza, personal reflective journal- freshman year, April 5, 2020). Many of the studying was in Spanish as I felt more comfortable with the language. In the mornings during breakfast break, everyone seemed to be focused and busy working on any assignment. There was a culture of helping each other and productiveness. "In the morning [during] breakfast [time] majority of the students in the cafeteria were either studying, completing an assignment, or discussing homework assignments" (A. Garza, personal reflective journal- freshman year, April 5, 2020). My friends were reviewing and prioritizing the assignments for the college classes.

Family

As mentioned by Chlup (2018), parents shape a student's aspiration for college. Chlup (2018) summarizes the ideas of "parental and parental background influence unequal access as seen across class, race/ethnicity, and income, especially for Latina/o first generation students" (p. 6). My mother is a physics teacher in Mexico, and although she obtained her bachelor's degree in Mexico, I consider myself a first-generation college student because I am the first in my family to obtain a college degree from a university in the United States. Her science background encouraged me to also seek an associate in science. My parents, specifically my mother,

encouraged me to consider a science related field and to obtain higher education. Parents are considered experts in their child development and are considered teachers at home because it is the mother who educated their child with cultural knowledge, values, and morals. Parents are the individuals who inspire and prepare their children to enroll in higher education. Research by Chlup (2018) suggests parental involvement, support, motivation, and encouragement are predictors of a student attending post-secondary education.

My family was another repeated theme throughout my data collection. My family is a factor which influenced me to major in science, additionally they help me develop my literacy skills in Spanish. They are the ones who encouraged me to do good. Their high expectations on my academic journey have always been to complete a bachelor's degree, aside from all the expectations, they helped me with anything they could. My way to appreciate everything my parents have done for me reflects the responsibility to make them proud. "I always felt the responsibility of having good grades and having good scores in math and science all the time I knew would make my parents proud" (A. Garza, personal reflective journal- freshman year, April 4, 2020). Because these subjects came naturally to me, I started to be more committed to learning about these two subjects, My love for math and science started in elementary as mentioned in my reflective journal, "I remember in my elementary years math and science were my outlet to demonstrate to my parents that I was smart. Math and science have always made sense for me" (A. Garza, personal reflective journal- freshman year, April 4, 2020). Both math and science were just so natural for me and I enjoyed learning about these subjects because learning environment provided.

My parents were invested in my education, and supported me in many ways, they helped me with my homework assignments, and encouraged an education. The importance of my

parent's involvement in my academics was quite present throughout my high school years because they understood the importance of obtaining an education. My parents were "committed to making sure [I] pursue higher education." (Goodman & Andres, 1999, p.179). To show their support toward my education, "they attended parent meetings which many times were in English" (A. Garza, personal reflective journal- senior year, April 4, 2020). Even if they didn't understand the language, my parents wanted to become familiar with the school environment, get as much knowledge regarding the classes I was taking, and meet my teachers. This showed how they valued my education and consistently demonstrated how much they cared about my education with their constant support.

Language Value

As defined by Anderson and Boyer (1970), bilingual education is instruction in two languages. Students are taught in two languages; (L1) students' first language and (L2) students' second language. Bilingual education is important for students in terms of academic achievements in the sense that students will be able to learn content in their first language and second language.

As stated by Pharr-San Juan-Alamo Independent School District (2020), the majority of students in the community are Hispanics. In this specific region, 82% speak the language as a first language. A bilingual program provides the opportunity for students to be biliterate- meaning students will be able to read, write, speak, and listen in both languages.

The school instructional environment in the bilingual classrooms at T-STEM provided me and the rest of the students with the opportunity to be part of the dual-language program. At T-STEM, there was a bilingual environment where many of my peers had been through bilingual programs during their elementary and middle school years. At the high school level, we were

presented with the option to be part of the dual-language enrichment program at T-STEM. From my experience, quite a few of my friends decided to take advantage of such opportunity. As mentioned in one of my reflective journals one of my friends, Adriana was also a chemistry major who "was part of the dual-language program and after taking Spanish classes throughout high school, in her high diploma she would receive a seal of bilingualism" (A. Garza, personal reflective journal- senior year, April 15, 2020). Being part of the dual-language program of T-STEM rewarded and recognized students with an additional seal of biliteracy. As part of the Dual-language program, students had to enroll in Spanish classes like world history, USA history, biology and each academic year to take a Spanish literature class. The dual-language program provided by T-STEM, as suggested by Cummins (2009), allows for students to develop their literacy skills at the same time. The purpose of the bilingual program, nonetheless, was to "teach subject matter content rather than just the languages themselves" (Cummins, 2009, p. 161). For example, my friend took a biology course where besides learning the required science content, she also simultaneously strengthened her Spanish since the class was in that language.

As suggested by Lindholm-Leary (2012), a dual-language program with a 50:50 model where instructions come in two languages means half of the time spent in a student's learning is conducted in their first language while the remaining half in their second. As I came to learn about the 50:50 model, I realized that throughout my high school years at T-STEM, the bilingual environment was imitating a 50:50 model. It is important for students to follow this model because students develop two languages simultaneously.

In a 50:50 model, instructional time is divided equally into both languages. At home or after school, activities, all communication was in Spanish; reading, writing, speaking was in Spanish. While at school, my classes were in English, specifically, the setting and language

environment I was exposed to followed Cummins' (2009) recommendation of being immersed at least 50% of the time in one language. Class instruction in English and, while at home, I used the Spanish language. I benefit from the bilingual environment and, as a result, I became biliterate. As supported by Flores and Beardsmore (2015), I fully developed my first language and an additional second language.

My classmates, for example, were part of a 50:50 model for dual language since half of their classes were in English while the other half were in Spanish. My classes in high school were all English, the only Spanish classes I ever took were the electives courses. I was not part of the dual language program because my dual-language classes conflicted with my college class schedule. Being part of the dual-language meant I would have to retake world-history and biology in Spanish. As reflected in my journal, "My 11th grade year was the hardest because of all the number of classes I was taking" (A. Garza, personal reflective journal- senior year, April 15, 2020). At the time, I was taking college algebra, physics, biology dual credit, U.S history dual credit, principles of health science, photography, and English composition I. The classes taken my junior year were college classes for the completion of my chemistry associate degree. My junior year at T-STEM, I actually would have the opportunity to be part of the dual program. However, I would have needed to repeat additional content classes.

My peers were part of a Dual language, I was not. Despite not being part of a dual-language program, I was still part of a bilingual environment where language was being valued. The instructional practices provided at T-STEM for students involved the use of a 50:50 Model Dual Language. For example, the chemistry teacher at T-STEM who tutored me, Mr. Lopez, would explain science content in Spanish, however, during class time my courses were in the English language. After school during tutoring time, Mr. Lopez "challenged us to critically think about

the [chemistry problems]. He made everything [seem] so easy" (A. Garza, personal reflective journal- senior year, April 20, 2020). I would use the English language to learn content in my class, however during lunchtime and after school I would use my Spanish language to solve math or chemistry problems. This method of doing things was helpful because I learned the content in English and then reinforced the new information in my first language. As supported by Zahner & Moschkovich (2011), the value of my first language helped me create meaning in a second language, English. There is learning of both languages, there is improvement and growth in the language, and both are developed at a high proficiency level as languages are being practiced.

At home my parents value the Spanish language, while my school taught me in English. Such balance of the two languages allowed for me to learn both in a more effective manner. In other words, the appreciation of my first language at home contributed to my literacy development in Spanish, while my school was helping me develop my literacy skills in English. For example, the practice of the Spanish language at home helped me develop my first language by reading stories in Spanish and helping me spell out words. The environment at home was surrounded by letters, words, books, and visuals with text which exposed me to better learn the Spanish language. As mentioned in one of my artifacts, the "text available at home were bible, textbooks and newspaper" (A. Garza, personal artifact- scholarship essay, January 15, 2015). The reading found at home was always in the Spanish language.

Summary

The reoccurring themes the STEM model and early college environment, support system, and language value answered the research questions by establishing that a STEM environment influenced my academic achievements towards my post-secondary education. Several characteristics which supported being in a STEM model and early college high school immersed

me in a rigorous academic curriculum to prepare me for college. The results demonstrated numerous factors that can influence a student like me to major in a STEM career. Another influencing factor was the support system provided by teachers, friends, and family are prime examples because they motivated and guided me through high school. The final influencing factor was language value which contributed towards earning an associate's degree in STEM related field. Class instruction was taught in the English and the Spanish language was practice at home. Language was being valued which facilitated my learning to bilingual and biliterate. The STEM Model and early college environment helped me to become familiar with the college setting while simultaneously helping me be college ready.

CHAPTER V

LIMITATION AND CONCLUSION

Limitations

This autoethnography has two major limitations; one of them being the occurrence of a pandemic, COVID-19, and the other missing artifacts. To begin with, these limitations involved making drastic changes in my methodology and research study. When I started the process of my M.Ed. thesis, I was planning on performing a case study with six participants; two current STEM bilingual Hispanic first-generation high school students, two former alumni from STEM PSJA who are also STEM bilingual Hispanic first-generation, one teacher, and one administrator. I was to conduct interviews, focus groups, and observation; however, during the pandemic, I was not being allowed on campus as the district of Pharr-San Juan-Alamo was, rightfully so, following restrictions and protocols in order to ensure the safety of everyone on campus. To avoid any human interaction, the methodology of case study was revised, and I had to change my research plans to conduct an autoethnography. Therefore, revisions to the original research went from focusing on the benefits of both current STEM students and alumni to focusing on my own personal benefits in attending a STEM high school. A second limitation of the study includes missing artifacts. It has been five years since I attended T-STEM and therefore several of my high school assignments were lost or thrown away. Most of the assignments kept from high

school were in a digital version such as college application essays, scholarship essays, lab reports, and projects. There were limited artifacts and those artifacts used for my autoethnography were my highest scoring assignments and best projects.

Conclusion

An extremely urgent matter that needs to be addressed is the low percentage of Hispanics students that are majoring in a STEM related field. STEM education provides students with a learning opportunity and prepares underrepresented groups by immersing them in rigorous programs and granting students the chance to earn a STEM degree by attending a STEM high school model. Specifically, in *La Frontera* the number of Hispanics who receive a bachelor's degree range from 12.8- 24.7% depending on the city (Census Bureau, 2019). STEM high school education is important for Hispanic students because it is a way to address educational attainment.

As a first-generation Hispanic bilingual college student, the STEM high school model influenced my academic achievement to obtain an associate degree in Chemistry and a Spanish bachelor's degree from Texas A&M. The STEM education I received at the high school level, as well as the supportive STEM environment, helped me achieve higher education. My story is a result of the benefits of the implementation of a STEM high school model. STEM presents an opportunity for the increasing number of Hispanics to become world leaders, by polishing and preparing them with skills, knowledge, and a critical way of thinking.

There is a need for Hispanic students to be in the fields of STEM. When first generation Hispanic college students attend a STEM high schools that provides them with the opportunity to obtain STEM college credit, not only they gain knowledge about college, but they also

experience a supportive environment that encourages them to major in the STEM fields. More specifically, the idea that a student with less opportunities can complete a STEM associate's degree during high school becomes possible.

Through the combination of early college environment, support system, and encouraging language development to English second language learners, first-generation Hispanic bilingual students will be college ready. College readiness, as defined by Ozuna (2016), includes the "strong relationships among schools, families, and community leaders and it should extend beyond traditional academic preparation in the classroom" (p. 154). In other words, when educators contribute to students' college readiness, students who are college ready gain personal attributes such as values, skill sets, and the knowledge necessary to be successful once students attend a college or a university. Learning beyond academic content is important for first generation college students. By preparing them for the college environment, by the time these students are on their own and are no longer high school students, they are already equipped with the skills necessary for the real- world.

In order for STEM schools to be successful for first- generation Hispanic bilingual students, they need to implement the following factors: academic rigor, a support system, and value language. Students are given the opportunity to become college ready and to become accustomed to the college environment. They earn a sense of understanding and familiarity with a college and STEM environment. The support in a small STEM campus is important because teachers lead and influence students to post-secondary education by equipping students with motivation and academic confidence. Furthermore, other factors of a support system include friends and family help a student during high school experience.

This research is an autoethnography which reflects my success story through a narrative inquiry. As a first-generation Hispanic bilingual student, the three major factors which contributed to my academic success at the high school level included: a STEM high school and early college environment, a support system, and language value. The research previously shown was written in my own perspective, the perspective of a Hispanic first-generation bilingual student who attended a PSJA STEM high school. The findings of my own personal high school journey makes this autoethnography unique because it focused on the research study and various components, STEM education, bilingual students and first- generation, and specifically on a STEM high school.

The specific research can be considered by high school administrators on STEM education as a guide to where the three factors are academic rigor, support system and language value, are provided to first-generation, bilingual, Hispanic students when teaching and promoting STEM education. Specifically, this research adds knowledge to the field of STEM education by seeing the lens from a bilingual perspective, as this research study highlights the important role first language plays in a STEM high school model.

This research study aims to define the reoccurring themes given through the educational system to a first-generation Hispanic student. Providing emergent bilingual students with a support system and teaching STEM-related courses in an easy manner that can be understood by students' first language is this research highlight. Students' first language value can be used as an academic resource and learning tool to help understand and acquire information. Even if a student is not part of a STEM early college-ready high school, academic support, motivation, academic guidance, and academic rigor can be implemented by students being prepared for the workforce, acquiring solving skills, and critical thinking skills.

The three recurring themes; academic rigor, support system, and language value throughout this autoethnography can become beneficial in other areas such as the medical field, business world, law enforcement, and any field of interest for first-generation bilingual students. This is because the skills acquired by going through “high school” or a similar program can be applied in their job career. The job pressure, expectations, and efficiency give students a mindset of continuous improvements and search for solutions for real-world problems. Hence, by implementing academic rigor, giving a support system, taking the STEM approach first-generation Hispanic students can have a vocation, become the first world-competitors.

REFERENCES

Allen, D., & Dadgar, M. (2012). Does dual enrollment increase students' success in college? Evidence from a quasi-experimental analysis of dual enrollment in New York City. *New Directions for Higher Education, 158*, 11-19.

Andersson, T., & Boyer, M. (1970). Bilingual schooling in the United States.

Calhoun, Y., Rangel, V. S., & Coulson, H. L. (2019). Educational resilience at risk? The challenges of attending an early college high school. *The Urban Review*, *51*(2), 301-325.

Chlup, D. T., Gonzalez, E. M., Gonzalez, J. E., Aldape, H. F., Guerra, M., Lagunas, B., … Zorn, D. R. (2018). Nuestros Hijos van a la Universidad [Our sons and daughters are going to college]: Latina parents' perceptions and experiences related to building college readiness, college knowledge, and college access for their children—A qualitative analysis. *Journal of Hispanic Higher Education, 17*(1), 20-40. https://doi.org/10.1177/1538192716652501

Collier, S., Burston, B., & Rhodes, A. (2016). Teaching STEM as a second language: Utilizing SLA to develop equitable learning for all students. *Journal for Multicultural Education*, 11(3), 257-273.

Committee on STEM Education. (2018). Charting a course for success: America's strategy for STEM education. *National Science and Technology Council*, 1-48.

Craig, J. C., Verma, R., Stokes, D., Evans, P., & Abrol, B. (2018). The influence of parents on undergraduate and graduate students' entering the STEM disciplines and STEM careers. *International journal of science education*, *40*(6), 621-643.

Crisp, G., & Nora, A. (2012). Overview of Hispanics in science, mathematics, engineering and technology (STEM): K-16 representation, preparation and participation.

Cummins, J. (2009). 10 Bilingual and Immersion Programs. *The handbook of language teaching*. Wiley Online Library.

Davis, M. A. (2009). *A study of the factors influencing successful experiences for bilingual students in a science classroom* (Doctoral dissertation). Retrieved from https://search.proquest.com/docview/305181468

De Brey, C., Musu, L., McFarland, J., Wilkinson-Flicker, S., Diliberti, M., Zhang, A., ... & Wang, X. (2018). Status and Trends in the Education of Racial and Ethnic Groups. NCES 2019-038. *National Center for Education Statistics*.

Duncheon, J. C. (2020). "We are exposed to that college environment": Exploring the socialization of early college high school students. *Community College Review*, 48(2), 173–194. Retrieved from https://doi.org/10.1177/0091552119898880

Ellis, C., Adams, T. E., & Bochner, A. P. (2011). Autoethnography: An overview. *Historical Social Research, 36*(4), 273-290. Retrieved from www.jstor.org/stable/23032294

Evans, L. M. (2018). A case study examination of exemplary literacy teaching in a cross-linguistic, cross-cultural learning environment. *Literacy Research and Instruction, 57*(4), 330-350.

Flores, Nelson., Beardsmore, H. B. (2015). 12 Programs and structure in bilingual and multilingual education. *The Handbook of Bilingual and Multilingual Education* Hoboken, NJ: John Wiley & Sons.

Gainen, J. (1995). Barriers to success in quantitative gatekeeper courses. *New Directions for Teaching and Learning*, *61*, 5-14.

García, O., & Kleifgen, J. A. (2010). *Educating emergent bilinguals polices, programs, and practices for English language leaders.* New York, NY: Teacher College Press.

García, O., & Woodley, H. H. (2015). Bilingual education. *The Routledge handbook of educational linguistics* (pp. 132-144). New York, NY: Taylor & Francis.

Gay, L. R., Mills, G. E., & Airasian. P. W. (2014). *Education Research Competencies for Analysis and Applications.* United, Kingdom: Pearson Education.

González, N., & Moll, L. C. (2002). Cruzando el puente: Building bridges to funds of knowledge. *Educational Policy, 16*(4), 623-641. doi:10.1177/0895904802016004009

Heyman, J. B. (2016). *Pathways into STEM among low-income, urban immigrant emergent bilingual/multilingual young adults: Opportunity, access, and persistence* (Doctoral dissertation, Columbia University). Retrieved from https://academiccommons.columbia.edu/doi/10.7916/D8KS6RHB

Hispanic and STEM education. (n.d). Retrieved from https://www2.ed.gov/about/inits/list/hispanic-initiative/stem-factsheet.pdf

Hoffman, N. (2005). Add and Subtract: Dual Enrollment as a State Strategy to Increase Postsecondary Success for Underrepresented Students. *Jobs for the Future*.

Lindholm-Leary, K. (2012). Success and challenges in dual language education. *Theory Into Practice*, *51*(4), 256-262.

McRobbie, J., & Villegas, M. (2004). *La frontera: Challenges and opportunities for improving education along the US-Mexico border*. San Francisco, CA: WestEd.

Means, B., Wang, H., Wei, X., Iwatani, E., & Peters, V. (2018). Broadening participation in STEM college majors: Effects of attending a STEM-focused high school. *AERA Open, 4*(4), 1-17.

Mejia, J.A., & Wilson-Lopez, A. (2015). STEM Education through Funds of Knowledge: Creating Bridges between Formal and Informal Resources in the Classroom. *Agricultural Education Magazine, 87*(5), 14–16. Retrieved from http://search.ebscohost.com.ezhost.utrgv.edu:2048/login.aspx?direct=true&db=eft&AN=102924258&site=ehost-live

Moll, L. C., Amanti, C., Neff, D., & Gonzalez, N. (1992). Funds of knowledge for teaching: Using a qualitative approach to connect homes and classrooms. *Theory into practice*, *31*(2), 132-141.

National Science Foundation. (2017). *Field of degree: Minorities*. Retrieved from https://nsf.gov/statistics/2017/nsf17310/digest/fod-minorities/degree-share.cfm

Nuñez, A. M., & Cuccaro-Alamin, S. (1998). *First-generation students: Undergraduates whose parents never enrolled in postsecondary education* (National Center for Education Statistics Report No. NCES-98-082). Retrieved from ERIC database. (ED 42023).

Ortlipp, M. (2008). Keeping and using reflective journals in the qualitative research process. *The Qualitative Report*, *13*(4), 695-705.

Ozuna, T. G., Saenz, V. B., Ballysingh, T. A., & Yamamura, E. K. (2016). Increasing Latina/o student success: Examining culturally responsive college readiness in the Rio Grande Valley of South Texas. *Journal of School Leadership, 26*(1), 154–182. https://doi.org/10.1177/105268461602600106

Pacific Policy Research Center. 2010. *Successful Bilingual and Immersion Education Models/Programs.* Honolulu, HI*:* Kamehameha Schools, Research & Evaluation Division.

Pérez Huber, L., Malagón, M. C., Ramirez, B. R., Camargo Gonzalez, L., Jimenez, A., & Vélez, V. N. (2015). *Still falling through the cracks revisiting the latino education pipeline* (Report No. 19). Los Angeles, CA: UCLA Chicano Studies Research Center.

Pew Research Center. (2019). *Mapping the Latino population, by state, county and city*. Retrieved from https://www.pewresearch.org/hispanic/2013/08/29/mapping-the-latino-population-by-state-county-and-city/

Pharr- San Juan- Alamo Independent School District. (2020). *About PSJA ISD.* Retrieved from https://www.psjaisd.us/domain/21

PSJA T. Jefferson T-STEM Early College High School. (2019). *Pharr-San Juan-Alamo ISD PSJA Thomas Jefferson T-STEM Early College High School Profile*. Retrieved from https://www.psjaisd.us/site/handlers/filedownload.ashx?moduleinstanceid=4770&dataid=15075&FileName=PSJA%20Thomas%20Jefferson%20TSTEM%20ECHS%20.pdf

Razfar, A. & Nasir, A. (2019). Repositioning English learners' funds of knowledge for scientific practices. *Theory Into Practice, 58*(3), 226-235. Retrieved from https://doi-org.ezhost.utrgv.edu/10.1080/00405841.2019.1599231

Region One Education Service Center (2020). *Demographic profile- region one ESC.* Retrieved from https://www.esc1.net/Page/14

Sáenz, K. P., & Combs, J. P. (2015). Experiences, perceived challenges, and support systems of early college high school students. *Administrative Issues Journal: Connecting Education, Practice, and Research, 5*(1), 105–117.

Sahin, A., Oren, M., Willson, V., Hubert, T., & Capraro, R. M. (2015). Longitudinal analysis of T-STEM academies: How do Texas inclusive STEM academies (T-STEM) perform in mathematics, science, and reading? *International Online Journal of Educational Sciences, 7*(4), 11–21. Retrieved from https://doi-org.ezhost.utrgv.edu/10.15345/iojes.2015.04.002

Satz, D. (2007). Equality, adequacy, and education for citizenship. *Ethics, 117*(4), 623-648. doi:10.1086/518805

Sharkawy, A. (2015). Envisioning a career in science, technology, engineering and mathematics: Some challenges and possibilities. *Cultural Studies of Science Education, 10*(3), 657-664.

Short, D. J. (2017). How to integrate content and language learning effectively for English language learners. *Eurasia Journal of Mathematics, Science and Technology Education, 13*(7b), 4237-4260.

Stringer, K., Mace, K., Clark, T., & Donahue, T. (2019). STEM focused extracurricular programs: who's in them and do they change STEM identity and motivation? *Research in Science & Technological Education*, 1-16.

Texas Education Agency. (2019*). Texas science, technology, engineering and mathematics (T-STEM).* Retrieved from https://tea.texas.gov/academics/college-career-and-military-prep/texas-science-technology-engineering-and-mathematics-initiative-t-stem

Texas Education Agency. (2019). *The early college high school blueprint.* Retrieved from https://tea.texas.gov/sites/default/files/201920%20ECHS%20Blueprint%20Redesign%206.11.19%20update%20to%20share.pdf

The Texas Tribune. (2019). *Pharr-San Juan- Alamo ISD*. Retrieved from https://schools.texastribune.org/districts/pharr-san-juan-alamo-isd/

Ugras, M. (2018). The effects of STEM activities on STEM attitudes, scientific creativity and motivation beliefs of the students and their views on STEM education. *International Online Journal of Educational Sciences*, *10*(5).

U.S. Census Bureau. (2019). *Quick facts United States.* Retrieved from https://www.census.gov/quickfacts/fact/table/US/PST045219

U.S. Census Bureau. (2020). *About the Hispanic population and it's origin.* Retrieved from https://www.census.gov/topics/population/hispanic-origin/about.html

Vargas, J. (2014). *Sharing responsibility for college success: A model partnership moves students to diplomas and degrees* (Jobs for the Future; Communities Foundation of Texas). Retrieved from ERIC database. (ED 561292).

White, D. W. (2014). What is STEM education and why is it important? *Florida Association of Teacher Educators Journal*, *1*(14), 1-9. Retrieved from http://www.fate1.org/journals/2014/white.pdf

World Population Review. (2019). *Hispanics population by state 2019*. Retrieved from https://worldpopulationreview.com/state-rankings/hispanic-population-by-state

Young, V. M., House, A., Wang, H., Singleton, C., & Klopfenstein, K. (2011). Inclusive STEM schools: Early promise in Texas and unanswered questions. In *Highly Successful Schools or Programs for K-12 STEM Education: A Workshop.* Washington, DC*:* National Academies.

Zahner, W. & Moschkovich, J. (2011). Bilingual students using two languages during peer mathematics discussions: ¿Qué significa? In K. Téllez, J. N., Moschkovich, & M. Civil (Eds.). *Latinos and mathematics: Research on learning and teaching in classrooms and communities* (pp. 37-62). Charlotte, NC: Information Age Publishing.

BIOGRAPHICAL SKETCH

Adriana Garza was born in Edinburg, Texas. She attended Pharr-San Juan-Alamo Thomas Jefferson T- STEM Early College High School, an early college high school where she took college courses. In 2015, she earned an associate degree in Chemistry from South Texas College, a local community college. Adriana was awarded the Gates Millennium Scholarship, a prestigious scholarship at the national level, which covers ten academic years of education. Earning this scholarship gave Adriana the opportunity to attend and graduate in 2018 from Texas A&M University at College Station with a Bachelor of Art with a major in Spanish and minor in Hispanics Studies. During the last semester of her undergraduate school, Adriana studied abroad at Centro de Lenguas Modernas de Granada, a University in Spain, Granada where she earned 12 college credits toward her Spanish major. In the summer of 2018, Adriana gained work experience from working at ARISE (A Resource in Serving Equality Support), a nonprofit organization that serves the Hispanic community. During her time at ARISE, she helped organize the summer reading program and assisted the youth during their Youth Leadership Retreat by helping them plan community projects. In 2020 Adriana earned her master's degree in bilingual education from the University of Texas Rio Grande Valley. Adriana desires to earn a Ph.D. in education. Mail correspondence should be sent to 506 W Dove Ave Pharr, Texas 78577.