CURRENT PERCEPTIONS OF SCIENCE AS A CAREER CHOICE OF UNDERREPRESENTED 11^{TH} AND 12^{TH} GRADE STUDENTS IN A LOW SOCIOECONOMIC AREA HIGH SCHOOL

by

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DISSERTATION

Presented to the Faculty of

The University of Houston-Clear Lake

In Partial Fulfillment

Of the Requirements

For the Degree

DOCTOR OF EDUCATION

in Educational Leadership

THE UNIVERSITY OF HOUSTON-CLEAR LAKE

May, 2020

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ABSTRACT

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The United States has a shortage of qualified workers in the science, technology, engineering, and mathematics (STEM) fields (Zhang & Barnett, 2015). There is a critical shortage of underrepresented students seeking science majors and possible science-based careers. The purpose of the study was to examine the perceptions of underrepresented juniors and seniors at a low socioeconomic status (SES) area high school about the need for science education in their possible college majors and future career choices. The study, consisting of 10 underrepresented students, developed common threads in the data collected that speak to the perceptions of underrepresented minority high school junior and senior students on science as a major and a possible career choice. The perceptions from the participants of the study may provide a clear picture for improvement of instructional strategies in science education.

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CHAPTER I:

INTRODUCTION

Introduction

The US has become more technical in its job offerings; there has been a shortage of high school students choosing science and technical degrees or careers. According to the Department of Labor (2009), science and technology-related careers were projected to add approximately 2.7 million new job opportunities in the workforce by 2018, accounting for nearly one-fourth of all new jobs (Zhang & Barnett, 2015). Although the use of technology is growing rapidly, the same cannot be said of the number of scientists and engineers, particularly in the underrepresented population of women and minorities. The United States has a shortage of qualified workers in the science, technology, engineering, and mathematics (STEM) fields (Zhang & Barnett, 2015). To add to this fact, the United States has fallen behind in academic scientific achievement compared to other countries (Heilbronner, 2011).

According to the research of Lent and Brown (2006), high school students have faced a much different world, with a large majority of available occupations requiring skills that were unheard of and levels of education that parents and older family members of today's adolescents rarely attained. However, even with the need for more science and technical career focused students, in low socioeconomic status (SES) areas, students tended to reflect the environment around them. Palardy (2013) determined in a study that the role of science for minority students living in high poverty areas has played very little in their decisions about future career and college major selection. In addition, Palardy noted that SES serves as a strong indicator for socioeconomic-related peer influences that directly impact student decisions about their future. Peer influences have had a major connection to attitudes, behaviors, and educational aspirations (Hallinan & Williams, 1990; Jang, 2002; Mounts & Steinburg, 1995; Palardy, 2013; Rumberger, 1983). The culture of the student in a low SES)was found to be developed by the experiences and observations of their home and school. The cultural perception of peer influences asserted that school peers have developed and supported social norms, educational values, and even academic skills through interactions at school, which in turn influence other students' attitudes and behaviors, and ultimately their cognitive development, attainment, and other educational outcomes (Dreeben & Barr, 1988; Enberg & Wolniak, 2010; Hanushek, Kain, Markman, & Rivkin, 2003; Jencks & Mayer, 1990; Kahlenberg, 2001; Orfield, 1996; Palardy, 2013).

According to Frisby (2013), there was a stark and clear relationship between the level of students' SES and their academic and social performance in school. The author notes that the educational characteristics of the working class were that the parents do not participate in the academic activities with their children. Frisby points to the fact that parents tended to feel intimidated by the administrators and teachers at the school and may not understand the terms used to describe their child's academic performance in class. Another part of this stark relationship between SES and academic performance was that the children who are in large schools in low SES areas were not being prepared for college; instead counselors were just trying to get them to graduate. The children of working-class families more often consider the cost of education and a perceived inability to continue educational endeavors after high school (Frisby, 2013). Additionally, the children of families that were in the underclass SES, making less than $15,000 a year, have a limited number of educational achievers, such as high school graduates, to look up to (Frisby, 2013). The schools they attended did not have the resources as that of more affluent schools. Furthermore, there was a low rate of school engagement from the students and a low graduation rate among this group (Frisby, 2013). Deficits in educational experiences comprise one model of thought about students who were in the lower SES experience. These deficits could have been the components of the achievement gap focus on human and financial resources, which low-income-serving schools typically lack (Pizzolato, Brown, & Kanny, 2011). Students from higher SES backgrounds tended to outperform students from lower SES backgrounds due to school quality, financial resources, and learning environment.

Quinn and Cooc (2015) conducted a descriptive analysis using archived data from the National Center for Education Statistics (NCES). The data came from the Early Childhood Longitudinal Study for the Kindergarten of 1999. From their examination of the data collected, they concluded that students from lower SES backgrounds tended to have poorer school quality, with less stimulating learning materials and a learning environment lacking opportunity to examine possible science connections (Quinn & Cooc, 2015). Quinn and Cooc's findings support Frisby's (2013) statement that many students in low SES areas and low performing schools in the study shared poor instruction, trite curriculum with few hands-on inquiries or meaningful projects. The students also shared the feeling that there was little support to study or participate in science from teachers, counselors, or principals. The feelings the students shared had a direct effect on what Aschbacher, Li and Roth (2010) referred to as students' science identity. In their research, science identity is defined as the sense of who students are, what they believe they are capable of, and what they want to do and become with regard to science (Aschbacher et al., 2010; Brickhouse, 2001).

Demographics such as socioeconomic status, race, and sex influence career motivations in varied ways (Boekeloo, Jones, Bhagat, Siddiqui, & Wang, 2015). Low-income families may focus their children on bringing money into the household and may not see any way to pay for college. Wang (2013) focused on the factors that act as barriers for students in low SES to pursue a four-year degree or a highly technical career. These factors included the need for financial resources and the student's level of academic skills to enter college (Wang, 2013). Students in families struggling financially may want to begin working full-time to earn money to support their families. Urban youth, particularly racial and ethnic minority adolescents from low income families and recent immigrants, are at risk for low educational attainment, limited future career options, and severely reduced earning potential (Jackson, Potere, & Brobst, 2006; Kozol, 1991; Lippman, Burns, McArthur, Burton, & Kaufman, 1996; Trust, 2000; Turner & Lapan, 2003). Stated plainly, if the families of low SES students do not see value in investing in a four-year science or math degree, then there is no support for students' technical career choices.

The United States has had a long journey to tap into the nation's science and technology talent. The goal to create more science and technology careers became harder to reach as the fastest-growing groups in the nation's population were also the most underrepresented in science and technology (Hrabowski & Henderson, 2017). Opportunities are available for underrepresented high school students seeking a career in science and technology in low-SES areas. Colleges and universities are facing a demand never seen before for an increase of underrepresented minorities and women students seeking careers in science and technology (Wang, 2013). Students in low SES may be able to find more scholarships to pursue careers in science and technology if they are made aware that there is a demand for students like them.

An increase in the number of underrepresented minorities and women seeking careers in science and technology could help to break the cycle of students in these areas seeking low-paying jobs. If younger children begin to see more examples of people in their communities working in science and technology, then perhaps the children will pursue the same careers. As children become older, their understanding of the importance of science and technology may become clearer, particularly, if they are inspired by scientists in the community. In order for more students from low SES backgrounds to see the value of pursuing science-related or technical careers, interacting with role models from these careers is essential. High school students' perceptions of science and possible career aspirations include comparing images of occupations and their own personal views of their level of compatibility (Sharkawy, 2015). Potentially, underrepresented student populations in low SES areas could have an increased interest in careers in science and technology if they are exposed to these careers in their lives.

Need for Study

There was a need to explore the perceptions of underrepresented secondary students on the importance of pursuing related fields in science as possible career choices since it is very unlikely that students would choose a career path with which they were not familiar. More exploratory, theory-based research could aid in the design and implementation of future intervention efforts aimed at promoting STEM educational and career pursuits among underrepresented student groups (Garriott et al., 2014). A current analysis of student perceptions of their science classes with an examination of whether the students in the low SES population see any need for science in their choices after secondary school was needed. Zhang and Barnett (2015) conducted a qualitative study that consisted of 34 open-ended questions that focused on why many urban high school minority students exclude science and other technical careers from their career choices. The study also sought to find out what experiences these students have had that influenced their plans for their future career. Zhang and Barnett (2015) found that the literature reviewed did not provide enough insight to how students see their career aspirations in relation to their surroundings or how their career goals may or may not be connected to the experiences of their education progressions to align with their career goals.

Purpose of the Study

The purpose of the study was to examine the perceptions of underrepresented juniors and seniors at a low SES area high school about the need for science education in future career choices. There is a shortage of minorities and female students pursuing science and technology careers given the need to increase their participation in these areas (Sharkawy, 2015). The study looked for common threads in the data collected that speak to the perceptions of underrepresented minority high school junior and senior students on science as a major and a possible career choice. The themes discovered in this study could provide educators with more understanding of the motivations of underrepresented minorities and how to meet their academic needs in science.

Research Question

The overarching research question was: What are the current perceptions of underrepresented high school students of the importance of science in choosing a future career?

Auxiliary questions which the study includes:

How did teachers influence student interest in science?

How did science course work and activities impact their interest?

How did students' own sense of ability (i.e., science efficacy) impact their interest in science?

What other factors impacted their interest to pursue science as a professional field?

Assumptions

The study was conducted under several general assumptions. The participants answered the interview questions honestly. The participants had similar science backgrounds. The participants understood there is no academic extra credit for participation and were interested in sharing their story for the sake of the story only. All participants were identified as students on the basic 4-year high school track with no endorsements. None of the participants were in any advanced science classes and had at least 3 years of on-level science.

Definition of Terms

Low social economic status student – Students whose families are the working poor making $25,000 to $40,000 a year and the underclass whose families make less than $15,000 (Frisby, 2013).

Self-Efficacy – Defined as the exercise of control over action and self-regulation of motivation, thought process, and affective states (Bandura, 1997).

Observational Learning – Model of thought and action is one of the most effective ways to convey information about the rules for producing new behavior (Bandura, 1986).

Social Cognitive Theory– Combines behavior, cognitive and behavioral factors, and environmental events which all operate as interacting determinants of each other (Bandura, 1986).

Social Cognitive Career Theory – Social cognitive career theory (SCCT) explains the three interrelated aspects of career development: (1) how basic academic and career interests develop; (2) how educational and career choices are made; and (3) how academic and career success is obtained (Lent, Hackett, & Brown, 2008).

Socioeconomic Segregation – The inequality of educational opportunity based on socioeconomic composition (Palardy, 2013).

CHAPTER II:

LITERATURE REVIEW

The purpose of the study was to examine the perceptions of underrepresented juniors and seniors at a low SES area high school about the need for science education in future career choices. The literature review for this study is in four parts. The first part discussed the theoretical framework for the research to provide a strong proven foundation of work which addresses how perceptions may be developed and what could possibly affect these perceptions. The second part examined socioeconomic composition by defining the term and how it may affect the learning and development of low income juniors and seniors. The third component of the literature review focused on low income junior and senior high school students' perceptions of science. The last part of the literature review focused on what effect a student's environment may have on the underrepresented high school students' ideas of science as a possible career choice. The review of literature looked for common threads in the data collected that speak to the perceptions of underrepresented minority high school junior and senior students on science as a major and a possible career choice.

Theoretical Framework

The theoretical framework for the study is the Social Cognitive Career Theory (SCCT) developed by Lent, Brown, and Hackett (1994). SCCT was developed and evolved from Bandura's Social Cognitive Theory (1996) and Bandura's work on Observational Learning. SCCT framework is stable for a wide range of populations in predicting math and science choices. According to Fouad & Santana (2016), high school students provided consistent evidence that successful learning experiences help to promote the development of self-efficacy, and outcome expectations. Self-efficacy in science is important in career development as stated in SCCT.

In order to explain SCCT, it is important to have a clear picture of the key aspects that help to make up SCCT. The SCCT framework includes focus on behavior, cognitive and other personal factors, and environmental events working together to help determine human functioning. SCCT engaged in more multigroup model testing to address questions of model fit across cultures, genders, communities, and regions (Brown & Lent, 2017). Interest and career choice models of SCCT could predict the building self-efficacy for math and science. SCCT would help to guide the development of positive and realistic outcome expectations for entering a STEM career, which would lead to realistic and investigative interests which would, in turn, lead to STEM career goals and preparation for, and entry into, a STEM occupation (Fouad & Santana, 2016).

Social Cognitive Theory

Social Cognitive Theory (SCT) is comprised of four capabilities. The first component of SCT is the Symbolizing Capability. Bandura (1986) explains that people transform transient experiences into internal models that act as guides for future action through symbols. People can give meaning via symbols of their lived experiences. In a study by Barton and Berchini (2013), Symbolic Engagement was one of the pathways for effective teachers to build in order to reach students in low SES science classrooms. According to Barton and Berchini (2013), Symbolic Engagement incorporates two elements: (a) understanding students' affective relationships with their location, and (b) challenging the relationships teachers have, with recognition of how these relationships symbolize broader values. Barton and Berchini further note that when teachers make themselves aware of their students' environments outside of class, the teachers were able to tailor the lessons in science to increase student understanding. Furthermore, newer teachers may need to learn more about the community surrounding the school in order to understand the students' symbolic relationships. The authors found that teachers had to consider students' Symbolic Engagement in place to redirect lesson goals in ways that remained rigorously scientific but also critical of meaningless guidelines (Barton & Berchini, 2013).

The second component of SCT is the Forethought Capability (Bandura, 1986). Through his research, Bandura determined people set goals for themselves. People also plan courses of action for well thought out possibilities. By using forethought, people can anticipate the outcome of events to help guide their actions.

The Vicarious Capability is the third component in SCT and addresses a person's capacity to learn by observation. Bandura (1986) stated that virtually all learning from direct experience can occur from observing others.

The final component of Bandura's SCT is the Self-Regulatory Capability (Bandura, 1986). Self-regulatory explains how people's behavior is motivated and regulated by internal needs. Self-regulations are built from external influences. These external influences do not negate the influences of self-influences. Bandura (1986) introduces personal reflection to help people gain understanding that allows people to alter their own thinking. Social Cognitive Theory analyzes learning in terms of the cognitive competencies necessary for acquiring knowledge and performance skills as referred to in Observational Learning Bandura (1986).

Observational Learning

A majority of people's behaviors are learned from observation through modeling. This is the foundation of Observational Learning. Observational Learning has four main components that transform modeled events of a person to a matching pattern. These components can be applied to the high school students in low SES regarding their level of self-efficacy in secondary science. These components are: Attentional Process, Retentional Process, Production Process, and Motivational Process (Bandura, 1986).

The Attentional Processes are used to decide what is observed and the vast array of possible modeling influences. Selective attention is a foundational component of observational learning. Several factors influence a person's decision on what is selected to be observed that is modeled in their environment. These factors include the cognitive skills of the observer; the observer's relation to the modeled activity; and the observer's types of human interaction.

Modeled events affect the amount of observational learning based on the complexity importance of the observer and how much the event stands out to the observer. It is important to note that children who distract easily have difficulties learning simple modeled activities. Student capabilities for understanding and using modeled information sets limits on the amount of observational learning that can be achieved from brief exposure (Bandura, 1986). An important addendum to the attentional processes is the growth of the Internet and social media, which are more distracters for students in observational learning.

The Retentional Process is the second component of Observational Learning. People must remember the modeled activity in order for that activity to be a great influence. Retention involves symbolic transformation in which information is transformed and restructured. The observer must transform what they observe into small necessary symbols in order to capture the most important features of the modeled activity.

There are two representation systems that Observational Learning relies on: imaginal and verbal construction. Imaginal constructions are more abstract than just mental snapshots of past memories. Observers pull distinctive features and form images of the behaviors seen. This means that students will develop behaviors they have observed and retained.

One theory of imitation from Holt (1931) points to the concept of when a child's behavior is copied by an adult: The child will repeat what he sees. This is called circular imitation. During this form of imitation, the adult's behavior becomes a positive stimulus for the child's responses. Even more interesting, if during this circular imitation, the adult performs a response that is different or more effective, the child will copy it. In social cognitive analysis, the person organizes behavior internally before it is executed. When a person observes modeled performances, one forms their own understanding of how to combine the act to produce new forms of behavior.

Cognitive processes that regulate behavior are mostly conceptual rather than imaginal (Bandura, 1986). Verbal representation accounts for the efficacy of observational learning. Practice is an essential means of enhancing retention. Homework is a form of practice. The purpose of homework is to support learning outside of school. Retention improves with repetition.

Rehearsal and symbolic coding are both needed to improve retention of modeled behavior. Cognitive rehearsal is time when the individuals visualize themselves being successful even when the actual event is impeded. Cognitive rehearsal can increase proficiency in activities.

Production Process accounts for the third component of observational learning. Behavioral production happens by organizing response in a space and time that are similar to the actual event. These processes involve synthesizing symbolic conceptions into the correct actions.

The Motivational Process (Bandura, 1986) is the fourth and final part of Observational Learning. Social cognitive theory separates the concepts of acquisition and performance. Problems develop between learning and performance when the learned behavior is of little value to the participant. High school students have a few major decisions; selecting a college major and career choice are two of those decisions.

Social Cognitive Theory and Observational Learning are integral components to understand how behavior affects learning and how knowledge is attained. In order to investigate student perceptions of science and if there are any aspirations to pursue a career in science, a combination of these two dynamics is needed.

Social Cognitive Career Theory

The Social Cognitive Career Theory (SCCT) (Lent, Brown, & Hackett, 1994) offers an explanation of career development of teenaged students and young adults from a sociocognitive behavioral foundation. SCCT is based on Bandura's (1986) Social Cognitive Theory and Hackett and Betz's (Ali, McWhirter, & Chronister, 2005; Hackett & Betz, 1981) career self-efficacy theory. SCCT asserts that personal, contextual, and social cognitive factors affect the development of interest, selection of goals, and behaviors in a possible career. SCCT underscores the combination of individual, environmental, and behavioral variables that are expected to support one's academic and career choices (Lent, Hackett, & Brown, 2008; Olle & Fouad, 2015).

Social Cognitive Career Theory (SCCT) brings together 3 components that are interrelated: (1) development of basic academic and career interest is developed, (2) how educational and career choices are made, and (3) how success is determined academically and career wise. These processes are major components of the SCCT used as the framework for this research. The SCCT is based on Bandura's (1986) general social cognitive theory, which underscores the interrelationship among individual, environmental, and behavioral variables that are assumed to undergird one's academic and career choices (Lent & Brown, 2006). The main components in SCCT include self-efficacy beliefs, outcome expectations, interests, environmental supports and barriers, as well as choice actions (Lent, Sheu, Gloster, & Wilkins, 2010). The components of SCCT spring from the processes of Observational Learning by having the experiences of the individual affect the choices made in every facet of deciding on possible careers. SCCT explains motivation and behavior through "emergent interactive agency" (Olle & Fouad, 2015, p. 534), wherein individuals exercise some control over their decisions about career choices but are also limited in their control by socioenvironmental factors.

Social Cognitive Career Theory is built from four essential variables: self-efficacy beliefs, outcome expectations, interest, and goals. SCCT also combines three models of academic and career interest development, choice, and performance. SCCT provides specific hypothesis firmly planted in the general social cognitive theory (Lent & Brown, 2006).

High school adolescents have their lives shaped by a procession of life events that help mold their personal development (Baltes, 1983; Hultsch & Plemons, 1979; Pajares & Urdan, 2006). Such life events include puberty, new educational demands, and social transitions as adolescents progress through the secondary grades. Interestingly enough, the students are preparing for a world that does not provide substantial ways of preparation for the tasks to come in life. Teenagers need to commit themselves to goals that give them a sense of accomplishment and have meaning in their lives (Bandura, 1997; Pajares & Urdan, 2006). One important factor of an education is to provide students with tools to become productive adults in society. Students' belief in their ability to succeed and be productive is referred to as self-efficacy (Bandura, 1977). The three main components of self-efficacy in the educational life of high school students for cognitive development and accomplishment are:

- Students' belief in their efficacy aids in determining their learning and mastering academic subjects.

- The teachers' personal efficacy to spark students' interest in the subject matter presented.
- The entire school faculty's sense of efficacy that their school can provide significant academic growth for their students (Bandura, 1997).

Outcome expectations are beliefs about the consequences of actions done by the individual. The questions of what will happen or what will I get if I complete this task or activity are part of this variable. Lent and Brown (2006) reported that self-efficacy in a particular area or domain could have growth through Observational Learning. SCCT reflects the sources of self-efficacy and expectations: performance accomplishments, verbal persuasion, and emotional and physiological stimuli. The authors determined that performance accomplishments would account for a larger change in self-efficacy, more so than other types of learning (Garriott et al., 2014). Outcome expectations could be met for an individual student by setting personal goals.

Personal goals are the intentions to do a particular task or career choice, even pursue a major in college (Bandura, 1986; Lent & Brown, 2006). Goals could be working toward a certain level of performance or grade. Setting goals helps an individual organize and guide their behavior during positive and negative moments to sustain the effort (Lent et al., 2008). Wang (2013) noted that SCCT incorporates the role of environmental supports and barriers in determining choice actions. After high school, students' pursuit of science as an academic goal relates to contextual supports and barriers, which could be social, academic, or financial (Wang, 2013). Support from peers and family have a strong connection and influence on career choices.

Three influences on career interest and choice are personal, cognitive, and environmental variables (Dika, Alvarez, Santos, & Suárez, 2016). Students who do choose science and math career pathways are influenced by their math and science achievement in high school (Chen & Simpson, 2015; Wang, 2013). Nonacademic factors in the development of interest in academic and career choices include gender, race or ethnicity, personal attitude toward math and science, and disability (Chen & Simpson, 2015; Lent et al., 2003). As Fouad and Santana (2016) proposed, SCCT theory can help those working directly with adolescents, because it can point directly to interventions that can influence adolescent decision-making (Sparks & Pole, 2019).

Socioeconomic Composition

Brown v. Board of Education was supposed to have abolished segregation due to the necessity to provide every student a proper education ("*Brown v. Board of Education.*," 1954). In 2007, after many battles to overturn *Brown v Board of Education*, the Supreme Court ended the recognition of racial balance for the states by deciding for the plaintiffs named *Parents Involved* (Crosnoe, 2009). In the case of *Parents Involved in Community Schools v. Seattle School District No. 1*, public schools were no longer required to desegregate but now had the choice to be desegregated (McNeal, 2009; *Parents Involved in Community Schools v. Seattle School District No. 1*, 2007). Although neighborhoods may have integrated racially, both the neighborhoods and schools have pronounced increases in resegregation along socioeconomic lines rather than racial lines (Altonji & Mansfield, 2011; Palardy, 2013). Although the Supreme Court ruled to abolish segregation based on race, a different form of segregation based on community economics is present. Socioeconomic composition (SEC) is commonly considered to have the most robust associations with student outcomes. For example, research suggests SEC trumps racial composition as a predictor of educational outcomes (Coleman et al., 1966; Jencks & Mayer, 1990; Rumberger & Palardy, 2005a). Does socioeconomic segregation reveal a domino effect on the students' perceptions on science and possible career choices?

Socioeconomic composition (SEC) measures the average SES of students in a school. SEC was shown to have the strongest connection to student achievement of any other factor (Palardy, 2013). High school SEC has been associated with high school graduation rate and 4-year college enrollments even when controlling for student background factors, such as SES, ethnicity, achievement, expectations, and engagement (Palardy, 2013). Palardy used data from the Educational Longitudinal Study of 2002 to investigate the quantitative relationship between high school socioeconomic segregation and student attainment outcomes. According to Palardy's research on SEC, high SEC high school students were 68% more likely to enroll at a 4-year college than low SEC high school students. A school's SEC level incorporated four measures of a school's student body composition and three measures of school resources. The four measures of the student body composition are family structure, percentage minority, prior achievement levels, and parental engagement. The four measures of school resources are student/teacher ratio, physical environment, equipment, and percentage of certified teachers. These seven factors listed had increased an individual student's probability of graduation and 4-year college attendance (Palardy, 2013).

According to Palardy (2013) there is a widening economic gap between low and high-income families, increased approximately threefold in school communities. Palardy also reports when this gap is coupled with the fact that schools are becoming more segregated then these components could possibly contribute to the students' perception on science and choice of a science-based career. The perceptions of students in low SES areas may not be improved by just throwing money at a situation, because little is known about how socioeconomic segregation impacts college-going behaviors (Palardy, 2013). This socioeconomic segregation has long-term consequences that need the greatest attention (Wells & Crain, 1994). Students living in economically depressed neighborhoods have a high probability of attending schools that are racially and ethnically segregated and are low performing with low graduation rates and limited resources (Balfanz & Legter, 2004; Dickinson, Abrams, & Tokar, 2017; Orfield, 2009; Washington, Hughes, & Cosgriff, 2012).

Palardy's (2013) quantitative study sought to find out how does student attainment, academic and family educational history, and school factor vary in low, medium, and high SEC schools. The study also sought to determine how do student factors such as peer influences and the quality of the school mediate the fulfilment in SEC associations. The study used data from the Educational Longitudinal Study of 2002 ("Educational Longitudinal Study," 2002) to investigate the connection between socioeconomic segregation and student attainment outcomes and the mechanisms that support those relationships. Palardy conducted this study to address the association between SEC and achieving academic goals, mainly college enrollment and other post-secondary outcomes such as job choice. The need to determine the perceptions of students in the poorer SEC has a deeper connection to the possible adult life choices the secondary students may make later on and what choices they may pass on to their children. The research of Palardy (2013) was supported by the work that showed the school affects how the student perceives science and the importance of the subject in choosing a college major or career (Rumberger & Palardy, 2005b). The research focused on the changes in the school that could have had positive effects on student perceptions. However, this study did not have a student voice, and the number of dropouts may continue to grow because the academic needs of the students on the fringe may not be met (Palardy, 2013). Although the schools in the study were in low SES segregated areas, school funding was not the issue.

Segregation by racial groups and low income status are nearly always associated with extremely large gaps in educational opportunity (Borman & Dowling, 2010; Kucsera, Siegel-Hawley, & Orfield, 2014). Palardy (2013) reported that, even though the federal government through President Barack Obama invested billions in education in reform with the goal that America will once again have the highest portion of college graduates in the world (*Race to the Top Fund*, 2009), there is still little known about how SEC segregation impacts perceptions about college-going behaviors. While segregation is a construct that was struck down in court, is there still a separation in the quality of education based on economics rather than race?

A three-part quantitative study was conducted in southern California in 2013 to determine if segregation is still a relevant issue. The researchers found that not only is segregation present, it has increased substantially. The authors of the study explored the fact of unequal access to positive learning opportunities and the effect this inequality has had on students (Kucsera et al., 2014). Kucsera's et al. study was composed of three parts. Part one reviewed the desegregation efforts since 1960. The second part investigated demographics and segregation patterns in public schools in Southern California. The researchers analyzed data from several sources. Data were comprised primarily of the 2008 to 2009 Common Core of Data from the National Center of Education Statistics (*Common Core of Data: Public elementary/Secondary school universe survey data*, 2008–2009). The third part of the study investigated the opportunities through the students' education and outcomes across schools in Southern California with different racial concentrations of students. The study used data from the California Department of Education to explore racial outcome gaps in areas between more affluent schools in comparison with segregated and intensely segregated schools. Kucsera's et al. (2014) research of literature determined that socioeconomically isolated schools are related to factors which include lower educational achievement that leads to limited lifetime opportunities for students in high poverty school settings (Borman & Dowling, 2010; Kucsera et al., 2014). As far as demographics, the study discovered a minority isolation where there are intensely segregated minority schools. Kucsera et al. noted that these schools were primarily associated with wide gaps in educational opportunity. Kucsera's et al. research found that in the intensely segregated schools' lack of safety due to overcrowding, ineffective learning environments were created. Another facet of intensely segregated schools of color—nearly one out of five of these schools experienced a severe shortage of qualified teachers. Intensely segregated and majority–minority schools of color experienced a greater shortage of advanced courses, college preparatory teachers, and college preparatory mathematics teachers than majority White/Asian schools (Kucsera et al., 2014).

Socioeconomic Composition did not speak to just low-income area schools. Chapman (2014) conducted a qualitative study consisting of a focus group of racial minority students in a majority White suburban high school to investigate the relationship between the impact of school adults, the educational experiences of the students, and future college and career possibilities. The study was developed by a community organization made of minority parents from suburban districts, university faculty from multiple local universities, and school district administration. The organization was created to address the achievement gap between students of color and White students in suburban districts. The research team conducted 22, 60–90 minute, focus group interviews with 97 high school students of color from six schools in four districts (Chapman, 2014).

The data were from audiotaped interviews with four to five students and the researcher. The questions were generally focused on three categories: high school, adult relationships, and academics. The findings of the interviews uncovered some of the same issues that students experienced in low performing schools. Students in the study were skeptical of their teachers. One reason for these perceptions from students of color, especially in the lower tracks, is the number of incidents in which teachers talk to them disrespectfully in class. Minority students felt that White students were given the benefit of the doubt and favored; whereas, Black and Brown students were considered trouble. The minority students in this study believed that counselors chose less rigorous courses for them and appeared disinterested in their course choices.

Although minority students in a majority White suburban school do have higher grades and rates of college attendance than their urban school classmates, they still feel anxiety, hostile school environments, and a lack of support from teachers and counselors. Chapman (2014) reported that even though the feelings of the minority students were not tangible, these feelings were possible unseen attacks on the minority students' self-esteem and academic confidence. Students of all backgrounds and cultures are present in the secondary school.

Multicultural Science Education

If teachers are to increase learning opportunities for all students, they must be aware of the social and cultural aspects of teaching and learning (Banks et al., 2001). Atwater defined multicultural science education (MSE) as a field of study using both qualitative and quantitative research to develop a set of policies and practices that enable students, no matter their background, to learn quality science (Atwater, Russell, & Butler, 2014). MSE finds support from Culturally Responsive Pedagogy (CRP). According to Ladson-Billings, CRP is a pedagogy that develops teachers who are thoughtful, inspiring, demanding, critical; they were connected to the students, their families, their communities, and their daily lives (Ladson-Billings, 2014).

Just as CRP has multiple components, MSE is more than just one component. MSE includes science curriculum, science teacher education, student learning and instruction, science assessment, and science evaluation (Atwater, 2010). Science education tends to lean toward remedies for the symptoms (e.g., retaining students of color, increasing standardized test scores, and quantifiable learning gains) and forgets to investigate the origins of these symptoms (Le & Matias, 2019).

Teacher education has to be addressed in multicultural education. The children in public schools are radically different from the Caucasian American students and instructors that are dominant in the country. Teachers need to recognize, respect, and educate the more racially and ethnically diverse student population (Gay, 2010).

Le and Matias (2019) presented consideration as to why what they refer to as whiteness needs to be a larger part of the conversation on diversity and inclusion as it relates to science education. Le and Matias (2019) stress that fixating on underrepresentation numbers and statistics without attention on the institutional norms and systems that cause these low representations undermines how oppressive a system can be. Given this, the students' feelings and opinions about their secondary science experience need to be continually considered.

Student Perceptions of Science

Although Dickinson et al. (2017) conducted a quantitative descriptive analysis study of African American college students using the SCCT, the findings of this study could be generalized for underrepresented high school students in science classes as well. The purpose of their quantitative study was to examine:

- The applicability of SCCT for African Americans with constructs defined in terms of Holland's realistic, investigative, artistic, social, enterprising, and conventional (RIASEC) themes.

- The role of specific learning experiences (performance accomplishments, vicarious learning, and verbal persuasion) in the development of self-efficacy and outcome expectations.

The researchers for this study examined the following hypotheses for each of the six RIASEC themes:

1. Each of the learning experiences will have a positive relation to self-efficacy and outcome expectations, and part of the relation of learning experiences to outcome expectations will be achieved through self-efficacy;
2. Self-efficacy will have a positive relation to outcome expectations;
3. Self-efficacy and outcome expectations each will have a direct relation to interests, and part of self-efficacy's relation to interests will be developed through outcome expectations;
4. Self-efficacy and outcome expectations each will have a direct and positive relation to choose goals, and those relations will be partially exhibited through interests;
5. Interests will have a direct relation to choose goals; and
6. Verbal persuasion will be a stronger positive predictor of self-efficacy and outcome expectations than will be vicarious learning and performance accomplishments.

The self-evaluation of a behavior determines which observationally learned concepts and behaviors most likely will be chosen. As students continue to perform modeled behavior in which they see the value, they are more likely to continue performing or exhibiting that behavior and avoid performances that affect the negative. The indication is strong that consequences influence the level of imitation of behavior. A student will judge the importance of a behavior based on their self-efficacy of that behavior rather than the emotional response for that behavior (Dickinson et al., 2017). The researchers' findings suggest that in their sample of African American students, the effect of self-efficacy for RIASEC-based occupations on the development of corresponding interests is transmitted via the anticipated consequences of pursuing those occupations (Dickinson et al., 2017). This finding suggests that, for African American college students, it may be likely that self-efficacy beliefs play a more vital role in the formation of positive outcome expectations in comparison to the direct development of interests and choice goals.

Despite the need for more science-based majors and careers in the United States for minorities and women, many of these students and their parents consider math and science irrelevant (Aschbacher et al., 2010). The term Science Identity coined by Aschbacher et al. describes a student's sense of self, their self-efficacy, and how science will impact their life in terms of a college major or employment (Aschbacher et al., 2010; Brickhouse, 2001). Most of the science discussed in public school is from the work done by scientists who are white European males (Aschbacher et al., 2010). Underrepresented students do not have a connection to many of the scientists studied. The students have a low science identity because of this. Several things could affect low SES students' perceptions of science in their secondary school life: a student's environment, self-efficacy, standardized testing, and the lack of resources in a low SES neighborhood school (Aschbacher et al., 2010).

Aschbacher et al. (2010) conducted a three-year survey study using interviews of 33 high school students to find out why some of them lost interest in science, engineering and math in high school and why some of them stayed in the pipeline as college science, engineering, and math majors. The researchers connected science identity to how students see themselves in relation to the ideas and concepts shaped largely by European middle-class males. Socializing agents like teachers, parents, and peers have an important role in determining how students access, summarize, and evaluate their personal life experiences. The life experiences of students affect their short- and long-term goals, attitudes, values, and priorities. Students are influenced by their relationships and daily social interactions with important people around them. The literature review in Aschbacher's study supports this. Research shows that teacher feedback, high expectation, and encouragement have a definite positive effect on student attitude and motivation, perception of competence and ability, and science career motivation (Aschbacher et al., 2010; Chouinard, Karsent, & Roy, 2007; George, 2000; Stake & Mares, 2001). Peer attitude, as research has shown, is a significant predictor of student attitude, interest in science, and enjoyment of science (Aschbacher et al., 2010; Fraser & Kahle, 2007; Simpson & Oliver, 1990). Personal interviews of students in grades 10 and 12 were used as the primary data for analysis. They developed a two 45-minute semi-structured interview format based on science education and pipeline resources (Aschbacher et al., 2010; Hanson, 1996; Seymour & Hewitt, 1997).

Observations from the research conducted showed a family's socioeconomic level was not a predictor of science interest for the 10th graders; however, the 12th grade students' socioeconomic levels did have an effect on experiences in high school science and college and career plans (Aschbacher et al., 2010). Aschbacher et al. also reported low achieving students in both low- and mid-SES with low science potential shared their disheartening school science experiences: their classes had many substitutes, uncaring science teachers, and curriculum that had no relevance to their lives (2010). The study uncovered ethnicity was more important than gender for both African American and Latina girls. Latina girls felt pressure to conform to traditions of staying close to home to care for the family. African American girls were more likely than the boys to participate in health academies and continue their quest in science throughout high school. The researchers determined from the data collected from the student sample that students who were provided with solid support for science in multiple communities were more likely to build up their science identities and continue in their science, engineering, and mathematics aspirations compared to students with less community support (Aschbacher et al., 2010).

Boekeloo et al. (2015) conducted a quantitative study on the role of intrinsic and extrinsic motivation for underrepresented minority high school students in Health Science Related Careers (HSRC) using an annual survey developed by Climb Up and Reaching Back (CURB). The researchers set out to determine if extrinsic motivation such as money and the possibility of prestige was as important as being authentically interested in HSRCs using data collected from the surveys. The University of Maryland conducted a two-year study of mostly low socioeconomic status high school minority students from six high schools in Prince George's County, Maryland. The population had a majority of racial minorities who were also high achieving academically, with a grade point average of at least a B-.

The sample for the study consisted of 173 students who participated in the CURB program from their 10th through 12th grades. The variables for the study were coded as sex, birth location, parents' citizenship, mother's education level, and race/ethnicities. Along with demographics, study conditions were coded in mentoring and education. The survey was used four times in four years of the study, so the results from the ninth-grade year were considered as baseline for the 10th, 11th, and 12th years in coding. Three schools were giving mentorship in HRSC, where the other three were not.

Extrinsic motivation was in the form of monetary compensation for completing the survey, i.e., each year $10 for the baseline and the first year, $15 the second year, $20 the third year, and $25 for the third year. The intrinsic motivation was discovered through a survey instrument. The researchers used a survey instrument constructed by a team of researchers, behavioral scientists, university students, and community members. Revisions for the survey were made after pretesting the instrument with high school students, and another review and pretest was conducted before the baseline was given to the participants.

The survey measured participants' responses to 25 questions on a scale from 1 to 7. One being "I do not want this" to seven, "I want this very much." The researchers used their own psychometric analysis where this served the basis of the intrinsic and extrinsic motivation scale. The reliability of the scale for the survey was based on factor analysis, correlation matrix, item-total correlation, and alpha coefficients (Boekeloo et al., 2015). The researchers concluded that intrinsic motivation is a better predictor of career choice than extrinsic motivation. The authentic interest in career choice is consistent with the self-determination theory (Deci & Ryan, 1985), because the theory suggests intrinsic motivation (engaging in an activity for its own sake) versus extrinsic motivation (engaging in an activity as a means to an end) leads to better engagement (Boekeloo et al., 2015). The study was limited to a specific geographic area and was focused on academically high performing minority students. The study's participants were two-thirds African American girls; the minority males were not fully represented.

Most research investigates the differences of achievement between the low, middle, and high SES students (Lee, Daniels, Puig, Newgent, & Nam, 2008). There is a direct relationship between self-esteem and educational achievement. Low self-esteem is one of the primary reasons for dropping out of school (Brodinsky, 1989; Lee et al., 2008).

A healthy self-esteem and successful learning experiences are critical components for positive postsecondary educational attainment (Lee et al., 2008; Wylie, 1979). There is research that attempts to describe the causes of the lack of science interest in the career choices of low socioeconomic status high school students. Limited insight exists on the factors that explain the patterns of achievement for low-SES students.

Student perceptions of science was organized into types in a study conducted by Wong (2016). The researcher used data from an exploratory qualitative study that investigated the science and career goals of minority students from age 11–14. Forty-six boys and girls from Black Caribbean, Bangladeshi, Pakistani, Indian, and Chinese backgrounds participated in semi-structured interviews. The study included classroom observations of 16 students. Students were interviewed individually on their thoughts, attitudes, and experiences of science, both inside and outside of school, as well as their current grades in, and career goals towards, science. The students' grades were taken into account as well and ranked as above average, average, and below average. Wong (2016) synthesized the data collected to develop five distinct science participation types: science adverse, science intrinsic, science intermediate, science extrinsic, and science prominent.

Science adverse classifies students who express no science career aspirations and low academic achievement in science. Science intrinsic students have interest in science and have low academic achievement in science. The classification of science intermediate is for students who express at least one science career goal. These students have average science academic achievement. The fourth group is science extrinsic, and this classification of students express no interest in science career aspirations and have average to above average academic performance in science. The final type discussed in this study is science prominent. The students in this classification have expressed science related career goals and have above average science academic achievement.

Wong (2016) provided three recommendations based on the study performed. First, raise attainment for the students who may have science career aspirations but are not performing well academically. Wong suggested having more after-school science clubs to build a stronger academic science focus for the student. The second recommendation was to widen the path to science careers by providing students with opportunities in science-related vocational opportunities and apprenticeships. The last recommendation was to retain scientifically competent teachers to provide support for students at all levels but especially for the science adverse.

An article reviewing research written by Fouad and Santana (2016) investigated how the SCCT may shed light on science and technology career choices and work decisions for underrepresented minorities and women. The focus of the article was on high school students' perceptions on science, because this time is a critical period in terms of career development as teens are taking specific classes in science (Fouad & Santana, 2016). Although STEM based careers encompass an increasingly wide range, from psychology and the social sciences, to biological and computer science, the underrepresented racial-ethnic minorities graduation rate has stagnated in these fields since 2000 (Falkenheim & Hale, 2015; Fouad & Santana, 2016). The research on SCCT with middle and high school students provides rather consistent evidence that successful learning experiences help to promote the development of self-efficacy and outcome expectations, and that self-efficacy in math and science is important in career development, specifically around supporting vocational choices, interests, goals, and actions starting in adolescence. The evidence also suggests that interventions to promote math and science career interests with underrepresented racial-ethnic minorities should attempt to build parental supports (Fouad & Santana, 2016). According to SCCT, environmental supports play a large part in students' decisions in career aspirations (Lent et al., 2010).

Student Environment and Science

Wang (2013) conducted a longitudinal study that involved finding the factors that are crucial to the interest in STEM fields. The research was conducted with the foundation of the Social Cognitive Theory developed by Bandura (1986) and the Social Cognitive Career Theory. SCCT focuses on the combination of individual, environmental, and behavioral variables that are assumed to develop the foundation of one's academic and career choice (Lent & Brown, 2006; Wang, 2013). Wang focused on the variables of underrepresented high school students' environment and behavior in school. Wang's (2013) study considered both secondary and postsecondary factors, and the students are from different subpopulations for analysis of multi-group structural equation models based on race, gender, and socioeconomic status (SES).

Racial, gender, and SES groups were assessed individually in Wang's research. Wang's questions for this study were: what relationships are there in high school science and math exposure and students' intent to pursue a STEM major in college; how are students' individual experiences (academic interactions, receipt of financial aid, and remediation) related to STEM in their lives; and how does race, gender, and SES affect these relationships?

Wang collected data for this study from the Educational Longitudinal Study (ELS, 2002) on 10^{th} graders in 2002, then additional data collected in 2004. This was the population's 12^{th} grade year. The second and final follow up collection in 2006 was conducted as a post-secondary benchmark. Wang believed that to get a better focus, it was important to follow the students from high school to post-secondary education (Wang, 2013).

The population for the study was approximately 14,000 students of the 2004 cohort. Out of the 12,500 that responded to the second survey, 19.3% had decided to major in a STEM field. This percentage of the population was the sample studied in this research. Wang investigated five variables. The first was the students' exposure to math and science according to each student's number of science, math, and technical credits in high school. The students' standardized math test scores were used to determine 12^{th} grade math achievement. The third variable was the self-efficacy of the 12^{th} graders in math. A four-point Likert scale measured the students' self-efficacy in taking math tests, mastering math skills, and completing math assignments. The last two variables, the 10^{th} graders' math achievement scores and their attitude toward math and science, were also measured using a four-point Likert scale.

Wang's research provided the following observation, the 12^{th} graders intent on a STEM career were positively influenced by 12^{th} grade math self-efficacy (Wang, 2013). This is important because if students are interested before they graduate secondary school, the students are more likely to seek a science or technical major. Finally, Wang found that math achievement was quite significant for 12^{th} grade minority students when selecting a science or technical major. If the minority student has a low self-efficacy in math, then there is little chance the student will pursue a major in math or science in college.

While the study did describe the relationship between self-efficacy in math and science in pursuit of a science or technical major in college, there is still a need to discuss the attitudes towards science of students in low SES area secondary schools. Wang was able to show that a positive attitude in math and science directly affects the career choices of 12^{th} graders. There is a need for more qualitative data for better understanding of what the students in low SES believe their choices are when it comes to using the science they have had in secondary school to help determine college majors and perhaps career choices.

Chemers, Zurbriggen, Syed, Goza and Bearman (2011) conducted a quantitative study on 327 undergraduate and 338 graduate students. Although the study focused on underrepresented minority college students, the finding from the study could provide useful insight on how to change the possible negative perceptions of minority high school students about science. The study was designed to have the participants rank the effects of the amount of support experiences, such as research, mentoring, and community involvement, in connection to their pursuing a career in science. The study focused on included variables such as science self-efficacy, leadership and teamwork, and their individual identity as scientists (Chemers, Zurbriggen, Syed, Goza, & Bearman, 2011). Their study showed that both undergraduate and graduate students reported that mentors and internships were key to their success in science. To measure science support experiences, the researchers wanted to isolate the effects of students in activities outside of classroom work such as science program assistance. When measuring research experience, Chemer et al. had 10 items measuring student involvement in science at different levels of complexity. Items on the survey included "I learned scientific language and terminology" and "I created my own explanation for the result of a study/research project." The graduate students had 11 more items more advanced in nature that ranged from "I was sole or first author on a paper or poster presentation on scientific content at a meeting of a professional organization" to "I supervised and trained undergraduate and graduate students" (Chemers et al., 2011). Community involvement was measured with a four-item scale containing items such as "I networked with fellow students" and "I participated in social events with faculty or staff members, and /or fellow students."

The science self-efficacy scale assessed students' confidence in their abilities to function as a scientist, as well as the students' personal rankings of their ability to lead a research team. The last two psychological variables were identity and the students' personal commitment in pursuing a science career.

Chemers et al. (2011) developed a model that showed science self-efficacy develop its paths from basic research experience, advanced research experience, and science mentoring. Identity was a combination of advanced research experience and socioemotional mentoring. Leadership and teamwork self-efficacy connect to basic and advanced research experience, community involvement, and socioemotional mentoring. The three psychological connections are science self-efficacy, leadership/teamwork self-efficacy, and identity-predicted commitment in a science career. Perhaps these findings could provide a framework for increasing the number of underrepresented minority high school students selecting science majors in universities and perhaps careers in science.

Zhang and Barnett (2015) conducted a qualitative study consisting of interviews that focused on why many urban high school minority students exclude science and other technical careers from their career choices. The study also sought to find out what experiences these students have had that influence their plans for their future career (Zhang & Barnett, 2015). The study consisted of a group of 60 students from the Boston Public Schools. The district has a majority of students who were minority or economically disadvantaged. Zhang and Barnett recruited these students into the Social Justice for Talented Emerging Minds (SJTEM) program, which is a technology-enhanced urban ecology program funded by the National Science Foundation's (NSF) Innovative Technology Experiences for Students and Teachers (ITEST) program. Out of the group of 60 students, five were selected for the program interviews conducted to collect data and look for possible correlations that may help to explain underrepresented students' career choices.

The data collected in the interviews were coded by career goals, previous experiences (general academic and science and technically academic), communications with others, and future motivations for participation in science and technology. The second coding for the data dealt with how clear and confident the responses of the students were. The researchers found through their analysis that the students who perceived science-related fields as their future occupations demonstrated relatively clearer plans to achieve their future aspirations. Students who saw other fields as occupations did not make connections between the present and the future and did not appear to have effective plans for their future.

Sethi (2015) conducted a study using survey methods of the attitude of students toward science in relation to factors such as gender, location (urban and rural), and socioeconomic status. Sethi used Allport's (1935) definition of attitude as a mental state of readiness to organize thorough experiences and the influence on behavior.

The opinion survey was used to determine the students' attitudes toward science. The sample for the study was 100 students using a random sampling technique from an urban and rural area. Sethi (2015) divided the sample 50 boys and 50 girls. Both groups were divided into 25 rural and 25 urban boys and girls. After the students took the survey, an analysis of variance (ANOVA) was conducted to determine if there was any significant difference in the attitudes of the students in the three categories.

The results were that the biggest difference in attitude about the importance of science in the study was between boys and girls. Location and socioeconomic status had no significant difference in attitude from one SES level to the other. Although the study was conducted in India and not the United States, the implications from the study have been supported in a study Sethi referred to that was conducted by von Roten. Von Roten (2004) used a phone survey of 1,000 men and women on their attitude about science and reported that gender played a bigger influence than socioeconomics. Sethi (2015) implied that teachers, parents, and counselors should help students develop a positive attitude toward science.

Summary

The literature provides little doubt that students are influenced by their relationships and daily social interactions with important people around them (Aschbacher et al., 2010). In the literature review, there is an overlap of the topics investigated, specifically that involvement by more than the teacher is necessary to promote positive effects on students' perception of science and its possibility as a career choice. This study will provide a more up-to-date picture into the perceptions of low-income underrepresented high school juniors and seniors about science, providing educators with more understanding of the motivations of underrepresented minorities and how to meet their academic needs in science.

CHAPTER III:

METHODOLOGY

Introduction

The purpose of the study was to examine the perceptions of underrepresented juniors and seniors at a low SES area high school about the need for science education in future career choices. This chapter discusses the methodology that will be used in conducting this study, including descriptions of: (a) research design, (b) research question(s), (c) participants, (e) instrumentation/interview protocol, (f) data collection procedures, (g) data analysis, (h) ethical issues, and (i) limitations of the study.

Research Design

The research was an explorative qualitative study utilizing in-depth individual interviews. The research was explorative in design. A select convenient sample of marginalized high school students provided data collected from interviews used to capture their meaningful experiences in secondary science. The data that was collected from individual interviews were valuable in exploring the research questions.

Research Questions

The overarching research question of this study was:

> What are some factors affecting underrepresented high school students' perceptions of the importance of science in choosing a future career?

Auxiliary questions which the query includes are:

a. How did teachers influence student interest in science?
b. How did science course work and activities impact their interest?
c. How did students' own sense of ability (i.e., science efficacy) impact their interest in science?

d. What other factors impacted their interest to pursue science as a professional field?

Participants

The participants for the study were selected using a purposive and convenience selection method. The researcher selected underrepresented minority students who were willing to participate in the interviews. This study employed a convenience sample of marginalized high school junior and senior students from a rapidly growing suburban school district in the Southwest. The convenient sample of 10 students was comprised of both genders with a range of academic achievement and from two minority cultural backgrounds (specifically, Hispanic or African American).

The school's Communities in Schools (CIS) program provided additional information on possible participants for the study in low SES families. CIS builds relationships that empower students to stay in school and succeed in life by partnering with communities to bring outside resources inside schools ("Communities In Schools," 2020).

The participants had the option to agree to participate in the interviews or not and could end their participation at any time. All participants signed either an assent or consent form (dependent upon age). For participants signing an assent form, the researcher acquired parental consent. All the students in the study were on the general education track with no additional endorsements.

Formal permission from the school district to conduct the research study were secured from the district's Internal Review Board (IRB) and the University of Houston-Clear Lake's Committee for Protection of Human Subjects (CPHS) prior to beginning the study. The high school principal, participants, and/or parents involved in the study were informed of its scope and purposes.

Setting

The Independent school district is located in southeast Texas. The district had a total population of 107,390 as of 2017 ("Education Demographics and Geographic Estimates," 2019). The district has 30 schools with three high schools. The district's demographics are below:

Table 3.1

Demographics of Independent School District Utilized in Study

Race	Percentage
White	43%
Black	15%
Hispanic	31%
Asian	9%
Two or More Races	2%

The high school from this district has a population of 2,178. The demographics for the school were as follows ("The Texas Tribune Public Schools Public School Explorer," 2019):

Table 3.2

Demographics of High School Utilized in Study

Race	Percentage
White	11.8%
African-American	41.2%
Hispanic	25.0%
Asian	19.2%
Two or More Races	2.2%
Pacific Islander	0.1%
American Indian	0.4%

Instrumentation

Instrumentation for the study involved an interview protocol. This interview protocol was used with all participants. The interviews were recorded and transcribed for qualitative data analysis (Creswell, 2014). The researcher engaged participants by posing questions in a neutral manner, listening attentively to participants' responses, and asking follow-up probing questions based on participants' responses in order to elicit in-depth discussion. The researcher allowed participants to answer the questions without any preconceived notions. Participants were encouraged to provide their own honest answers without appearance of approval or disapproval of the interviewer (Mack, Woodsong, MacQueen, Guest, & Namey, 2005).

Interview Protocol

For the purpose of this study, the following Interview Protocol questions were used with each participant to promote uniformity of the interviewing process:

1) Do you like science?
    a. Tell me a story about an impactful experience.
2) Share your thoughts about high school science classes.
    a. What did you find interesting?
    b. What did you find challenging?
    c. Share what you remember about your teachers.
    d. Share what you remember about interesting activities or instruction.
    e. Share what you remember about the content of your science classes.
    f. Do you feel that you have science skills?
    g. How would you rate yourself on how much science you know?
3) What do you plan to do after high school graduation?
    a. Does your career choice involve any science skills (if so, what are they)?
4) Did your science courses/experiences in high school have anything to do with you choosing or not choosing the science field?

Data Collection Procedures

Qualitative data was collected through individual interviews scheduled at a convenient time for the participants. The interviews were important and allowed the participants opportunities to explain their perceptions and increase the flow of data to be used for the development of themes. Prior to conducting the interview, participants signed an assent or consent form. They were introduced to the purpose of the interview to discuss their perceptions on science and their future goals after high school graduation to help educators better meet the academic interest needs of future underrepresented high school students. The interview was audio recorded using a digital audio device. The data was transcribed for analysis.

Data Analysis

The Grounded Theory approach was utilized to generate theories to explain how perceptions about science of marginalized high school students is shaped by coursework, teachers, and students' own ability. Grounded Theory uses a series of cumulative coding cycles and reflective analytic memoing to develop major categories for theory generation (Miles, Huberman, & Saldana, 2014). The goal was to develop themes that emerged from the individual interviews of 10 high school students.

The interviews of the underrepresented students were transcribed by the researcher for analysis. Line by line investigation was used to develop coding. The researcher wrote the codes on sticky notes and placed them on the wall. The codes developed were then grouped into categories. Saturation was achieved when data collected was organized and no longer sparked new insights (Creswell, 2014). Finally, themes were developed from the categories and are shared in the results section.

The constant comparative method is a tool for analyzing data gathered from the separate interviews of six participants in order to develop a grounded theory. Glaser and Strauss (1967) suggest that, when used to generate theory, the comparative analytical method they describe can be applied to social units of any size. As Glaser and Strauss (1967) describe it, this process involves:

- Identifying themes in the stories of the participants from the interview in this case.
- Identifying similar concepts, principles, structural or process features of the participants' experiences in science and the effect of these experiences on their possible college major and career choices.

The researcher can only make decisions regarding initial collection of data based on one's initial understanding of the phenomenon. Additional data collection cannot be planned in advance until the initial analysis and the emergence of theory (Glaser & Strauss, 1967).

Qualitative validity for this study meant that the researcher checked for accuracy of the data recorded. Member checking and interviews of 45 minutes per participant were used to provide rich thick data used to develop themes. Rich thick data addressed the formation and habitation of the participants, the connection of student practices with the constitution and transformation of experience. These components are indispensable and need to be included or the analysis would not be complete (Geertz, 2000; Springs, 2012). In other words, rich thick data sought to explain the relationships between the perceptions of underrepresented juniors and seniors about their science education and their opinions about pursuing possible careers in science. Member-checking consisted of the researcher taking the themes discovered back to the participants interviewed to give them an opportunity to discuss the findings (Creswell, 2014). The researcher clarified the bias he brought in to the study as an African American in science education.

Ethical Issues

Before asking any interview questions, the researcher sought informed consent for the study. For in-depth interviews of participants who were minors, informed consent required that parents or guardians of the participants sign a written informed consent document (Mack et al., 2005). Integrity of the study required a commitment to minimizing the risks associated with research collected and the process utilized. One aspect to minimize risk involved the use of pseudonyms for all participants, their schools and the school district. Additionally, all participants were informed that they had the option to remove themselves from the study at any point in the interview. The researcher also clarified any potential biases as an African American in science education. The data collected from the students was the only information used in the study.

Limitations

The study was conducted in the school where the researcher currently teaches; thus, this may have an effect on the students' candor in responding. The students participating in the study were not current students in, or students who have ever been in, the researcher's science classes. Another limitation for this current study was that students may provide answers they believe the researcher may want to hear. Also, the participants may be expecting to receive some academic benefit for their participation. Due to the difficulty in interviewing every underrepresented junior and senior in the school there was limited generalization reflected in the sample size.

CHAPTER IV:

FINDINGS

Introduction

The purpose of this qualitative study was to examine the perceptions of underrepresented juniors and seniors at a low SES area high school about the need for science education in future career choices. The research was an explorative qualitative study utilizing in-depth individual interviews. It was explorative in design, in that data from the interviews will capture meaningful experiences of a select, convenient sample of marginalized high school students regarding their experiences with science and science coursework.

This chapter will present the findings data analysis uncovered to answer the following research questions:

RQ: What are some factors affecting underrepresented high school students' perceptions of the importance of science in choosing a future career?

The supporting questions for this study are:

- How did teachers influence student interest in science?
- How did science course work and activities impact their interest?
- How did students' own sense of ability (i.e., science efficacy) impact their interest in science?
- What other factors impacted their interest to pursue or not pursue science as a professional field?

The results of the data were coded and analyzed to uncover themes connected to the perceptions of underrepresented high school students about their high school science and possibility of pursuing a science based-career. This study employed a convenience sample of underrepresented high school junior and senior students from a rapidly growing suburban school district in the Southwest. The convenient sample of ten participants was comprised of both genders of students with a range of academic achievement from a minority cultural background (specifically, Hispanic or African American). The participants had the option to agree to participate in the interviews or not and were advised that they could end their participation at any time. The interviews took place during the individual student's science class with their teacher's approval. All participants signed either an assent or consent form. For participants signing an assent form, the researcher acquired parental consent.

Participant Demographics

The sample for this study was comprised of 10 high school students from a local high school. Underrepresented students were the focus of the study. Provided below in Table 4.1, is a breakdown of the grades, gender, and race of the selected participants. The names have been changed to protect the anonymity of the participants.

Table 4.1

Demographics of Participants

Name	Gender	Race	Grade
Sayjah	Female	African American	12th Grade
Chris	Male	Hispanic	12th Grade
Edward	Male	Hispanic	11th Grade
Eric	Male	African American	11th Grade
Madelyn	Female	African American	11th Grade
Joseph	Male	African American	11th Grade
Iiona	Female	Asian	12th Grade
Curtis	Male	African American	11th Grade
Diana	Female	Caucasian	12th Grade
Julius	Male	African American	11th Grade

Research Question: Perceptions of Science

The central research question focused on the perceptions of underrepresented juniors and seniors at a low SES area high school about the need for science education in future career choices. The data collected from the interviews were analyzed for themes.

Table 4.2 displays the major themes and sub-themes identified from the interview data collected. Line-by-line analysis of responses for each interview were organized by questions on the interview protocol shown below:

1) Do you like science?
    a. Tell me a story about an impactful experience.
2) Share your thoughts about high school science classes.

a. What did you find interesting?
b. What did you find challenging?
c. Share what you remember about your teachers.
d. Share what you remember about interesting activities or instruction.
e. Share what you remember about the content of your science classes.
f. Do you feel that you have science skills?
g. How would you rate yourself on how much science you know?

3) What do you plan to do after high school graduation?
   a. Does your career choice involve any science skills (if so, what are they)?
   b. Did your science courses/experiences in high school have anything to do with you choosing or not choosing the science field?

The interviews of the underrepresented high school students on their perceptions on secondary science and their choice of a possible science-based major in college and a career were coded using the In vivo method (Miles, Huberman, & Saldaña 2014). The researcher used words and short phrases from the participants' interview transcripts. Three categories of responses emerged. The three categories of responses were delineated by participants' interest in science and include:

- No connection to science
- Enjoys science but has non-science goals
- Enjoys science and wants to pursue a science major and career

The three categories are listed in Table 4.2 below, along with themes identified within those categories, supported by researcher's notes on specific participant responses. It must be noted here that the third category, where participants enjoy science and choose to pursue it as a career, shared all of the themes in the second category and apply to the participants who fell under this category as well. In table 4.2, the only themes listed specifically in the third category are those unique or exclusive to those choosing to pursue a science career.

Table 4.2

Categories of Participants' Science Interest with Themes and Supportive Notes

	CATEGORIES with THEMES	Number of Students
Perception 1	No connection to science	4
Themes ->	Lack of Interest • *No effect* • *Non-science career aspirations* • *Science is not challenging* • *Science has no impact on me*	
	Science Challenges • *Lack of science skills* • *Low science skill rating by student* • *Science too difficult* • *Too much memorizing*	
Perception 2	Enjoys science but has non-science goals	3
Themes ->	Science Resonated with their Interests • *Enjoys science* • *Found science interesting* • *Favorite subject*	
	Possessed Science Skills • *High self-efficacy science rating* • *Science stood out as something they did well*	
	Instructional Support • *Positive teacher input*	
	Interactive Processes • *Hands-on investigations* • *Collaboration and small groups*	
Perception 3	Enjoys science and wants to pursue a science major and career	3
Themes ->	Applicable and Relevant • *Students had real world applications of science* • *Science related to everything*	
	Pre-determined • *Career choice was made before high school*	
	Secondary Pedagogy and Curriculum Excellence • *High school science had biggest influence on career choice*	

Table 4.3 presents data on how students rated themselves from 1 to 10 on their own science skills, which indicates personal confidence in their ability to function as a scientist (Chemers et al., 2011). The personal rating of one meant no confidence in a participant's own science skills, while a self-score of ten indicated extreme confidence in their science skills. Having the students evaluate their own science skills is supported by the work of Dickinson et al. (2017). The self-evaluation of behavior determines which learned concepts and behavior will be most likely chosen.

Table 4.3

Science Skills Rating

Name	Science Skills	Science Rating out of 10	Grade
Sayja	I think I do	7	12th Grade
Chris	Yes	6 or 7	12th Grade
Edward	Yes	9	11th Grade
Eric	A little	6	11th Grade
Madelyn	I do	7	11th Grade
Joseph	Somewhat	8	11th Grade
Iiona	Yes	8	12th Grade
Curtis	Yes	7.5	11th Grade
Diana	Not really	3	12th Grade
Julius	Yes	10	11th Grade

Table 4.4 shows the participants plans after high school. Some participants (*n*=6) interviewed felt that their science classes in high school have had an effect on their plans after high school. The remaining four out of ten did not feel their secondary science classes had any effect on their choices after high school.

Table 4.4

Plans After High School

Name	Plans after High School	Did your science classes impact your decisions?	Grade
Sayja	Major in Music Education	Yes, most definitely.	12th Grade
Chris	Construction Engineer	No, it didn't	12th Grade
Edward	Health Sciences	No.	11th Grade
Eric	Architectural Engineering	Science did have a little to do with it	11th Grade
Madelyn	Science and Business	It did. Since I enjoy it Maybe I want to work in that field	11th Grade
Joseph	Business and Finance	Yes	11th Grade
Iiona	Physical Therapy	Yes, it does.	12th Grade
Curtis	Major in Law	Yes actually. My science teacher was a former lawyer.	11th Grade
Diana	Culinary career	I really don't think so.	12th Grade
Julius	Information Technology	No, because I already had an idea of what I wanted to do before high school.	11th Grade

Discussion of Categories and Themes

The data collected from the line by line transcription of the interviews was used to develop themes grounded or pulled from the information provided by the participants in their personal interviews. Referring back to Table 4.2, the three perceptions—no connection to science, enjoys science but has non-science goals, and enjoys science and wants to pursue a science major and career—were developed from themes constructed from the categorized responses of the participants in the individual interviews. The section below will discuss the themes revealed in each perception.

No Connection to Science

The first perception presented was the participants that had no connection to science. The participants described a lack of interest and challenges they experienced in their secondary science classes. The grounded themes developed from this perception shared by the participants were lack of interest and science challenges.

A lack of interest in science was expressed by participants who said they did not like high school science. The students that shared no connection to science offered that science had no effect on their plans for college major or career goals. One student felt that science did not provide any challenge and was boring. Students with a perception of no connection to science had a low self-rating of their science skills.

Diana S., a female Caucasian senior, shared her perceptions on science in an interview. Diana had no interest in majoring in science or having a science career. She saw no need for it in becoming a chef as science had no real applications to her life. Diana rated herself a 3 out 10 in terms of having science skills. She shared this when asked if science was important to her: “It's fine, but to me it’s not my favorite. It’s just ever since I was little because my mom would always teach me how to cook. That was something that stuck with me.”

Eduardo C., a male Hispanic junior, revealed that he does not remember much of the science he had in high school but is choosing a career in either art or health science. This was peculiar because, even though Eduardo wanted to perhaps have a career in health science, he still felt that his secondary science classes had no effect on him. When asked if his high school science classes had any effect on his career choice he shared this: "No. Because. as a very young kid I very much knew what I wanted to do."

Christopher F, a male, Hispanic senior, was more on the fence about his perceptions on science as he indicated that science can be interesting. He rated himself between a six or seven out of 10, meaning he felt confident in his ability to do scientific investigations. Christopher shared that, if he had studied more, his science skills would be stronger. Christopher did not feel that science was not interesting for him.

What was important to note was that Christopher did not connect his career aspiration of becoming a construction engineer to his science classes. His career aspirations were from his family in construction and pursuing it as a profession.

The other theme to be pulled out in the perception of no connection to science was the challenges faced in science. Science challenges included a lack of science skills, low science skill rating by student, difficulty, and too much memorizing. Christopher F stated what he found challenging in his science classes:

> "Maybe solving equations with electrons and neutrons. In my IPC [Integrated Physics and Chemistry] class, we had to do certain things that to make us understand gravity and how it works. So, it was challenging using certain things for different materials."

Memorizing was a large component in the science challenges theme. Chemistry has a periodic table of elements, and the task of memorizing all of the elements on the chart can be quite daunting. Diana shared her thoughts on this: “I would say what I found challenging was when they brought up the periodic table.”

Eric G., a male African American junior, did not enjoy his secondary science classes. When asked if he liked science he replied, “a bit”. Eric did enjoy how the scientific method was developed to solve problems. The challenging parts of science for him were specific: “Solving equations. Especially that train track system [in chemistry] because you have to cancel stuff out.” Eric rated himself at 6 out of 10. He wants to be an architecture engineer and realized that science had some impact on his career choice.

Enjoy Science but Has Non-Science Goals after High School

The perception of students enjoying science but not wanting to pursue a science based major or career was shared by six out of the 10 participants. The participants with this perception felt that the science aspects of experimenting and investigating resonated with their interests in school. The participants who shared this perception found science interesting and considered science their favorite subject and rated themselves as having a high level of science skills. The participants with this perspective enjoyed the lessons provided by their teacher. The instructional supports used by their teachers were collaborative groups, small group lab activities, and positive teacher interaction.

The participants’ perceptions of enjoying science without looking forward to a science based major and career was shaped by instructional support. Instructional support for the students was positive teacher input. Participants sharing this perception gravitated toward the interactive processes, such as lab group investigations in the classroom. Hands-on and small group collaborations were more favored of the lab group investigations. In support of this claim, Sayja D., a female African American senior, provided this statement about interactive processes in the classroom:

> "The activities helped because I was practicing what I was [being] preached and why it was important. It is one thing to have to remember all of we did but another thing to put it in to play. For me, I am someone who learns by doing so by doing labs it helps me with learning not memorization."

The participants who shared this perception have a high self-rating of their science skills. The participants believed in their science skills, and science was a subject they did well in in school. Participant comments support the idea that their enjoyment in science came from positive instructional strategies used in their science classrooms.

The perception of enjoying science but not seeking a science related major can be an area to focus on when addressing the need to increase the number of underrepresented high school students to seek science majors. The students sharing this perception not only enjoyed science but had a high self-rating of their science skill (at 8+). Science stood out as a favorite subject for these students. Positive teacher input was also key in this perception. Students who enjoyed science also enjoyed the hands-on collaboration in the laboratory investigations. Participant comments offered below highlight the attraction to science but wanting to pursue non-science options.

Sayjah shared that science did have a profound effect on her choice to major in music in college to become a music teacher. The science of sound was exciting to her, because learning how to calculate frequencies applied to her love of music. She recounted that science was one of her favorite subjects. Sayjah rated herself a seven out of ten even though she enjoyed the subject and said:

> "In biology I learned about the systems such as reproduction in chemistry. I remember the elements, learning about molar mass and things like that. Definitely the mole. In Environmental Studies we talked about third world countries and how they do things compared to the US. And definitely about like nuclear stuff,

> like Chernobyl. Astronomy—we learned there are different solar systems and planets, and I am still interested in astronomy stuff today. Learning about lower pitch and higher pitch and that there is a science to music."

Curtis B., a male African American junior, liked science because of the excitement of it. The hands-on experiments were enjoyable for him. What Curtis found challenging was trying to memorize the periodic table. He felt his science teachers in high school cared about him and were focused on his learning. Curtis rated himself a 7.5 out of 10 for science skills. Curtis wants to be a lawyer: "The science teachers were very open about the science classes and they were also exerting positive energy."

Julius D., a male African American junior, felt that science was one of his favorite subjects, because he always did the best in science. He found biology to be most interesting, because he learned about the body systems. What he found challenging was that the content in his science class grew in complexity. He rated himself a 10 out of 10 with strong science skills. With all of that, however, he felt his career choice of information technology had no connection to science: "The courses I took this year did not have anything to do with my career choice. We have old computers at home that I can take apart and find out how they work. That is what got me the most interested."

Julius had been taking apart old computers before he became a high school student. As he showed an interest in how computers work, his parents supported his interest by providing him old computers to disassemble. Although he may not connect the secondary science classes to his interest, his interview showed the effect parental support has on a possible career choice.

Enjoys Science and Wants to Pursue a Science Major or Career

The third perception developed from the coding of interviews was students who enjoyed science and looked to pursue a science based major in college, and a career in a science related field. The students sharing this perception had the same coding as students who enjoyed science but did not want to pursue a science based major or career. The difference for this perception was that the students were able to see real world applications for the science they studied. Students with this perception of pursuing a science major and career started during high school with some interest of pursuing science after high school. Science classes in high school were a large influence for them.

The three out of ten participants' interview data provided three grounded themes:

1. Found science to be applicable and relevant
2. Pre-determination
3. Secondary pedagogy and curriculum excellence

Science to these participants was connected to real world applications. Each student was able to see a need for science in their world. Madelyn B., a female African American junior, had decided on a major in science. Although she did not specify which branch, she saw that her classes gave her options to pursue that appealed to her. Iiona H., a female African American senior, learned in biology about the systems and parts of the body. Iiona shared this when asked why she liked science: "I'm taking anatomy. And she (my teacher) explains very good. I want to go into the medical field so I need it." Iiona realized that the science she had taken in high school, especially anatomy, applied to the field of medicine. The course instructor helped the student make this connection.

Joseph W., a male African American junior, enjoyed the hands-on experiences in his science classes. One of the things that affected his positive perception on science was the teachers in his science classes. Joseph felt like biology stood out the most to him because he was allowed to collect cotton swab samples to test for germs. Joseph wanted to go to college for business and finance, and his career aspiration was to become an owner of a gym chain. He believed that his science class will be necessary to serve his customers.

He wanted to turn his physical fitness aspiration into a business model, combining his enjoyment of science with his goal to have his own business. Joseph's goal was owning his own gym. The knowledge he received in his science class gave him the understanding that science is related to everything and does apply to his dream of owning a gym. "You have to understand a body anatomy. People that are physical fitness experts can get a degree in that [anatomy]."

The classroom provided these participants opportunities to have hands-on instruction. Laboratory activities were very important to connect the concepts covered in science to the students' interest in investigating the world around them. All of the participants who shared the perception of enjoying science and wanting to pursue a science college major and career were able to point to experiments and science activities as having an influence. Joseph shared an experience in his high school environmental science class that made quite an impression on him:

> "We had environment systems so I mean we would take it outside like it was more hands-on. I was like she'll take us outside to collect dirt. You know by any means to make jugs where ecosystems were made. We got to make our own filter, bring our own fish and everything. That was very interesting."

Lessons such as making personal ecosystems in jugs have more effect than just lecture. Madelyn provided another example of how the use of science lessons using hands-on investigation connected the concepts studied in chemistry to real world examples: "We did chemical reactions like fire and like different colors of flames and how it relates to things like alcohol." Madelyn was able to connect the color flames to energy and chemical reactions through investigation.

Madelyn enjoyed her biology class the most, learning about DNA and RNA and how important they are to life. Madelyn shared that “facts are facts”. Madelyn did find math was the challenging aspect of her science classes. The science teachers in high school up to the time of the interview had a great effect on perception as well, Madelyn added: “A lot of them [science teachers] worked at labs before they became like a teacher. They were really smart.” Madelyn felt that her science courses had a direct effect on her choices to pursue a science based major and possible career. Madelyn wants go to college to major in science or business. Her experiences in her science classes had a direct effect on her choices. Madelyn added: “It [experience in science class] did. Since I enjoyed it. Maybe I want to work in that field.”

Iiona H., a female African American senior, shared her perception of science by saying the she does like it. Iiona wants to have a career in the medical field. Her favorite science classes were Biology and an elective Anatomy. She found remembering formulas challenging. Iiona rates herself at a 7.5 out of 10 in science skills. Ilona was interesting as her rating was below an 8, but she does want to pursue a science-based career. It is important to note that Iiona transferred to the school at the beginning of her senior year. She mentioned that the school she came from had a permanent substitute teacher for science.

Conclusion

Three perceptions were developed from the 10 participants of the study based on the data collected from the interviews of each one. The first perception shared by the underrepresented high school juniors and seniors was no connection to science. The participants who shared this perception did not enjoy science nor did they believe science had any connection to their lives other than just being a class in school. The second perception was participants enjoying science but having non-science-based goals for college and their career. Although these particular participants enjoyed science and believed they were proficient in their science skills, the students did not see a connection of science to their college major selection. The final perception presented here was from the participants that enjoyed science and wanted to pursue a science-based major and possible career. The high school participants who shared this perception were able to make a connection of what was studied in their secondary science class to real world applications they were interested in pursuing.

CHAPTER V:

SUMMARY OF FINDINGS, IMPLICATIONS, AND RECOMMENDATIONS

Statement of Problem

There is a shortage of minorities and female students pursuing science and technology careers, given the need to increase their participation in these areas (Sharkawy, 2015). The purpose of the study was to examine the perceptions of underrepresented juniors and seniors at a low SES area high school about the need for science education in future career choices. The study looked for common threads in the data collected that speak to the perceptions of underrepresented minority high school junior and senior students on science as a major and a possible career choice. The themes discovered in this study could provide educators with greater understanding of the motivations of underrepresented minorities and how to meet their academic needs in science.

Summary of Findings

The researcher examined and analyzed the perceptions of underrepresented juniors and seniors at a low SES area high school about the need for science education in future career choices. The researcher explored the perceptions of underrepresented secondary students on the importance of pursuing related fields in science as possible career choices. In order for more students from lower SES backgrounds to see the value of pursuing science-related or technical careers, these students must have opportunities to be exposed to these careers. Underrepresented minority students must be allowed the chance to succeed beyond their perceived limitations in science. The researcher sought to provide a current analysis of student perceptions of their science classes and an examination of whether the students in the low SES population see any need for science in their choices after secondary school.

The study conducted defined themes from codes developed from the data collected which speak to the perceptions of underrepresented minority high school junior and senior students on science as a major and a possible career choice. The main research question for the study was: What are some factors affecting underrepresented high school students' perceptions of the importance of science in choosing a future career?

Social Cognitive Career Theory (SCCT) was used as the foundation for the research conducted. SCCT correlates basic academic and career interest, educational and career choices, and how academic and career success is obtained (Lent, Hackett, & Brown, 2008). The SCCT framework includes focus on behavior, cognitive and other personal factors, and environmental events working together to help determine human functioning (Lent, Brown, & Hackett, 1994). The literature also suggested that students who do choose science and math careers are influenced by their high school math and science achievement (Chen & Simpson, 2015; Wang, 2015).

The research for this grounded theory investigation was an explorative qualitative study utilizing in-depth individual interviews. The study was explorative in design because data from the interviews was used to collect the meaningful experiences of a select, convenient sample of underrepresented high school students regarding their experiences with science and science coursework.

Qualitative data was collected through individual interviews scheduled at a convenient time for the participants. Prior to conducting the interview, participants have signed an assent or consent form. They were introduced to the purpose of the interview to discuss their perceptions on science and their future goals after high school graduation to help educators better meet the academic interest needs of future underrepresented high school students. Each interview was recorded using a digital audio device. The data was transcribed for analysis. Codes were developed and grouped into three major themes:

- Students with no connection to science
- Students who enjoyed science but are not pursuing a science major or career
- Students who enjoy science and are pursuing a science major and possibly a career

The Grounded Theory approach used a series of cumulative coding cycles and reflective analytic memoing to develop major categories for theme generation (Miles et al., 2014). The themes developed in this study are presented in Table 4.1. The codes developed were from line by line analysis of each interview transcription. Member checking consisted of the researcher taking the themes discovered back to the participants to discuss their opinions on the findings (Creswell, 2014).

There remains a need to know what are the perceptions of underrepresented minority students about science so that changes can be made in instruction to meet the needs of these students. Students who have repeatedly said that strong instructional strategies in the classroom along with caring teachers did have a strong effect on the participants' self-rating of their science ability. SCCT provided the connection between improving behaviors in science classrooms which could increase the number of underrepresented minority junior and senior high school students' choice for science-based careers.

Contributions of Literature

The purpose of this study was to examine the perceptions of underrepresented juniors and seniors at a low SES area high school about the need for science education in future career choices. An interview protocol was used to collect data to determine the themes discussed in this chapter.

The three perceptions drawn from the line by line analysis and coding were students with no connection to science, those who enjoyed science but were not pursuing a science related major and career, and those who enjoyed science and decided to pursue a science related major and career. These perceptions are supported by the research findings of Wong (2016) from the review of literature. Students were individually interviewed on their thoughts, attitudes, and experiences of science, both inside and outside of school, as well as their current grades in, and career goals towards, science. Wong (2016) synthesized the data collected to develop five distinct science participation types: science adverse, science intrinsic, science intermediate, science extrinsic, and science prominent.

The high school juniors and seniors in this study provided a more up to date picture of their perceptions of science in their possible career choices. All of the data to develop the themes that identify factors affecting their perceptions of the importance of science were directly tied to each participant's interview. Three perceptions became evident from the development of codes from line by line analysis of each interview.

The first major perception was students who had no connection to science. Lack of interest was a contributing theme present in this perception. The students rated themselves below a 6 on a 1 to 10 scale. The students with this perception do not see science as interesting or too difficult. The students felt there was too much memorizing and formulas. The participants who shared this perception also felt the theme of science challenges was too much for them. As discussed by Aschbacher et al. (2010), the students considered math and science irrelevant. If students feel no connection to science, then the subject becomes irrelevant and difficult.

The second major perception students shared was that they enjoyed science but were not pursuing a science-based college major or career. The participants who were classified in this category felt they possessed science skills. Students who shared this perception rated themselves 8 and above on their own science skills. These participants believed that science resonated with their interests. The students enjoyed the experiments and investigations in class. Instructional support was a theme that came out of the interviews of the participants, showing the importance of capable teachers who have provided opportunities for hands-on investigation and small group collaborative learning. Their teachers have provided them with positive learning experiences. This point about positive teacher interaction in their science classes points back to the literature. Barton and Berchini (2013) noted that when teachers make themselves aware of the students' environments outside of class, the teachers were able to tailor the lessons in science to increase student understanding. Strong interactive processes in the classroom were essential, including hands-on investigations, collaboration, and small groups.

The study conducted by Wong supported the themes that speak to the importance of instructional support and excellence in curriculum and secondary pedagogy. Wong (2016) provided three recommendations based on the study performed. First, raise attainment for the students that may have science career aspirations but are not performing well academically. The second recommendation was to widen the path to science careers by providing students with opportunities in science-related vocational opportunities and apprenticeships. The last recommendation was to retain teachers that were scientifically competent to provide support for students at all levels but especially for the science adverse. Science adverse students in Wong's study compared directly to the students who shared the perception of no connection to science in this study.

Teacher feedback, high expectation, and encouragement have a definite positive effect on student attitude and motivation, perception of competence and ability, and science career motivation (Aschbacher et al., 2010; Chouinard et al., 2007; George, 2000;

Stake & Mares, 2001). For students sharing the perception of enjoying science but not seeing science as a major in college or possible career choice, this was mainly due to the fact that the students had a career choice in mind before they became high school juniors or seniors. According to Wong (2016), they are considered science extrinsic. This classification of students expressed no interest in science career aspirations and had average to above average academic performance in science. The third perception was students who enjoy science and want to pursue a science major and possible career. Students sharing this last perception enjoyed science as well. The students in this category see science as a subject that is applicable and relevant.

Research shows that teacher feedback, high expectation, and encouragement have a definite positive effect on student attitude and motivation, perception of competence and ability, and science career motivation (Aschbacher et al., 2010; Chouinard, Karsent, & Roy, 2007; George, 2000; Stake & Mares, 2001). A majority of the behaviors of students are learned from observation through modeling. This is the foundation of Observational Learning (Bandura, 1986). The differences for them was the real-world applications the students were able to experience in class, and the students were able to connect their science aspirations to the science classes they have taken. The students in this category had some idea of a science-based career before high school from observing the careers of people in their communities. Students wanted to major in science because of the success experienced in class. As the literature supported, performance accomplishments would account for a larger change in self-efficacy more so than other types of learning (Garriott et al., 2014).

Implications of Study

This study examined the perceptions of underrepresented junior and seniors about the need for science education in future career choices. Along with past research, the findings of this study have implications for science teachers and school instructional leadership to support the increase in science education and science career interest. Specifically, the results of this study indicate that students who enjoy science and had chosen to major in science in college had similar accounts of the importance of a strong teacher and hands-on investigations.

The central implication of the study is to provide educators additional tools to reach students who are continually overlooked and marginalized. Science is about investigation. Children are inquisitive by nature. The research showed the relationship between effective teaching and positive perceptions in science. There must be more of an effort to provide underrepresented minority students some of the same opportunities for more hands-on collaborative science investigations. Although the underrepresented minorities in this study did not see scientists in their communities, school can provide mentors in science through teachers. The science teachers have the greatest impact on underrepresented minorities in their secondary science classes. The perceptions of secondary science in underrepresented minorities who feel no connection to science must be addressed.

Recommendations

The purpose of this study was to examine the perceptions of underrepresented juniors and seniors about the need for science education in future career choice. Now that the perceptions have been examined and themes have been developed, the next steps would be to develop instructional strategies to increase authentic learning environments. There are opportunities to find out what actions best meet the needs for increasing the number of underrepresented students to seek science related career goals. It is recommended that discussions with the district science curriculum leadership about the importance of caring and supportive teachers will provide more opportunities for students to become more interested in the secondary science course work. The themes revealed provide avenues for further analysis to be done, perhaps in determining relationships between the science skills self-assessment and teacher influence. The students who have no connection to science have shared that they did not see the need for science in their life. Teachers can develop instructional strategies to address the perception of no connection to science to include students that feel disconnected. As far as the perception of enjoying science but not pursuing a science major, perhaps more science experiences outside the classroom could help students develop a stronger connection to science. There is an opportunity to also conduct a survey of underrepresented high school students who are going to college to major in science to provide the school with information to help evaluate the effectiveness of their college and career preparation. The focus of the survey would inquire about what specifically was the science teachers' influence on the students' decision in hopes of providing instructional tools for new teachers to better serve all students.

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APPENDIX A:

INTERVIEW CONSENT FORM

INFORMED CONSENT TO PARTICIPATE IN RESEARCH

You are being asked to participate in the research project described below. Your participation in this study is entirely voluntary and you may refuse to participate, or you may decide to stop your participation at any time. Should you refuse to participate in the study or should you withdraw your consent and stop participation in the study, your decision will involve no penalty. You are being asked to read the information below carefully and ask questions about anything you don't understand before deciding whether or not to participate.

Title: CURRENT PERCEPTIONS OF SCIENCE AS A CAREER CHOICE OF UNDERREPRESENTED 11TH AND 12TH GRADE STUDENTS IN A LOW SOCIOECONOMIC AREA HIGH SCHOOL

Student Investigator(s): Kelvin C. Kibler

Faculty Sponsor: Dr. Lisa Jones

PURPOSE OF THE STUDY

The purpose of the study is to conduct a current analysis of student perceptions of their science classes and an examination of whether the students in the low SES population see any need for science in their choices after secondary school.

PROCEDURES

The research procedures are as follows: After informed consent has been obtained, participants will either complete a survey and/or participate in an interview. The interview with the researcher will last approximately 45 minutes. With permission of the interviewee, the interview will be audiotaped and transcribed in its entirety. Pseudonyms will be utilized to protect the identity of the participants. A transcription will be sent to the interviewee to check for accuracy and clarifications. Surveys will be completed electronically, and participants will be assigned numbers to maintain confidentiality. District and campus names will not be used.

EXPECTED DURATION

The total anticipated time commitment will be approximately 45 minutes for participating in an interview.

RISKS OF PARTICIPATION

There are no anticipated risks associated with participation in this project.

BENEFITS TO THE SUBJECT

There is no direct benefit received from your participation in this study, but your participation will help the investigator(s) better understand factors that have an effect on your perceptions about science as a possible career choice.

CONFIDENTIALITY OF RECORDS

Every effort will be made to maintain the confidentiality of your study records. The data collected from the study will be used for educational and publication purposes; however, you will not be identified by name. For federal audit purposes, the participant's documentation for this research project will be maintained and safeguarded by the Faculty Sponsor for a minimum of three years after completion of the study. After that time, the participant's documentation may be destroyed.

FINANCIAL COMPENSATION

There is no financial compensation to be offered for participation in the study.

INVESTIGATOR'S RIGHT TO WITHDRAW PARTICIPANT

The investigator has the right to withdraw you from this study at any time.

CONTACT INFORMATION FOR QUESTIONS OR PROBLEMS

The researcher has offered to answer all your questions. If you have additional questions during the course of this study about the research or any related problem, you may contact Kelvin Kibler .

The Faculty Sponsor Dr. Lisa Jones, EdD, may also be contacted.

SIGNATURES:

Your signature below acknowledges your voluntary participation in this research project. Such participation does not release the researcher(s), institution(s), sponsor(s) or granting agency(ies) from their professional and ethical responsibility to you. By signing the form, you are not waiving any of your legal rights.

The purpose of this study, procedures to be followed, and explanation of risks or benefits have been explained to you. You have been allowed to ask questions and your questions have been answered to your satisfaction. You have been told whom to contact if you have additional questions. You have read this consent form and voluntarily agree to participate as a subject in this study. You are free to withdraw your consent at any time by contacting the Student Researcher or Faculty Sponsor. You will be given a copy of the consent form you have signed.

Subject's printed name:____

Signature of Subject: ____

Date: ____

Using language that is understandable and appropriate, I have discussed this project and the items listed above with the subject.

Printed name and title: ____

Signature of Person Obtaining Consent: ________________________________

Date: ____

THE UNIVERSITY OF HOUSTON-CLEAR LAKE (UHCL) COMMITTEE FOR PROTECTION OF HUMAN SUBJECTS HAS REVIEWED AND APPROVED THIS PROJECT. ANY QUESTIONS REGARDING YOUR RIGHTS AS A RESEARCH SUBJECT MAY BE ADDRESSED TO THE UHCL COMMITTEE FOR THE PROTECTION OF HUMAN SUBJECTS (281-283-3015). ALL RESEARCH PROJECTS THAT ARE CARRIED OUT BY INVESTIGATORS AT UHCL ARE GOVERNED BY REQUIREMENTS OF THE UNIVERSITY AND THE FEDERAL GOVERNMENT.
(FEDERALWIDE ASSURANCE # FWA00004068)