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GIRL POWER: HOW CAN SCHOOL COUNSELORS EMPOWER FEMALE STUDENTS TO STUDY STEM-RELATED MAJORS IN COLLEGE AND BEYOND?

Carly Bank

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ABSTRACT

GIRL POWER: HOW CAN SCHOOL COUNSELORS EMPOWER FEMALE STUDENTS TO STUDY STEM-RELATED MAJORS IN COLLEGE AND BEYOND?

Carly Bank

There is a gender gap among females studying STEM (Science, Technology, Engineering, and Math) majors and pursuing STEM careers. More males than females pursue these majors and careers. This study explored how high school counselors influence the choices of STEM majors for female students. The researcher explored the perspectives of seven experienced high school counselors who work with students on college exploration and career planning activities in this multi-case study. The processes these counselors apply when working with female students and improving these practices so school counselors can better support their students was examined. Key findings of this study suggest that school counselors play critical roles in helping their students explore college and career options. It is essential to establish a relationship between each student and their school counselor to serve each student individually. Counselors are aware of this gap and are interested in decreasing it. They are interested in learning more about STEM-specific majors to serve their students best. They offer suggestions on specific and relevant training opportunities to help them continue learning. They are eager to help their students, as well as their colleagues, learn and grow within their professions.

DEDICATION

I lovingly dedicate this dissertation to my family. Brian, Marshall, and Sean. Thank you for your support and patience throughout this journey. I am so grateful to each of you. Brian, thank you for your constant encouragement and support. Words can't describe how much your humor and technology skills are appreciated. Sean and Marshall, part of why I did this was to show you that learning never ends and hard work pays off. I hope those lessons linger in you.

This is in loving memory of my father, Dr. Martin Jay Nottes. Your sense of humor, love, and dedication continues to inspire me daily.

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I would like to acknowledge my parents, Shirley, who taught me the meaning of what a strong female can do, and my stepfather, Bobby. Thank you to my in-laws Helaine, Gary, and Agnes. I am so grateful to and for all of you. Thank you all for entertaining, chauffeuring, and feeding my children when I was unavailable.

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To all my friends, thank you for constantly checking in and cheering me on. They say it takes a village, and I am so lucky to be surrounded by such a strong and loving village to call my own.

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CHAPTER 1

Introduction

There is a gender gap among females studying STEM (Science, Technology, Engineering, and Math) majors and pursuing STEM careers. More males than females tend to study those subjects and work in those fields. The National Center for Education Statistics reported that overall, women earned 58% of bachelor's degrees in 2015-2016 compared to 42% for males. However, 36% of women earned bachelor's degrees in STEM fields compared to 64% of males (NCES, 2020). According to the United States Department of Labor (2022), females comprise 16.1% of the engineering workforce (BLS, 2020). This is important as it shows a significant gender discrepancy. This study will examine the gender gap in STEM careers and how high school counselors influence the choices of STEM majors for female students.

Purpose of the Study

The purpose of this study was to explore how high school counselors influence the choices of STEM (Science, Technology, Engineering, and Math) majors and careers for female students. This study gathered multiple perspectives from high school counselors regarding their work with female students interested in the STEM fields. Their perspectives can inform other high school counselors on how to best support their female students who are considering pursuing STEM fields to study in college and as career opportunities.

The STEM workforce provides innovation and valuable societal contributions (National Science Foundation, 2023). There is an increase in the need for STEM workers

due to the constant evolution of technology. In 2021, 34.9 million people worked in STEM occupations, an increase from 29.0 million in 2011. Today, 24% of the employees in the United States are working in STEM occupations (National Science Foundation, 2023). There is a gender gap in the academic (NCES, 2022) and professional environments (Legewie & DiPrete, 2014; U.S. Department of Labor, 2020) in STEM areas.

A gender gap exists among many STEM careers. Some of the jobs that have fewer females working in them include the following percentages of women: 35% of environmental engineers are female; 32% of computer and information scientists are female; 25% of biological and biomechanical engineers are female; 24% of industrial engineers are female; 18% of computer programmers are female; 18% of chemical engineers are female; 18% of software developers are female; 17% of civil engineers are female; 13% of aerospace engineers are female; 12% of computer hardware engineers are female; 10% of electrical engineers are female; 9% mechanical engineers are female; and 8% of petroleum engineers are female (Society of Women Engineers, 2023). This data demonstrates that a gender gap exists, and a need for research regarding those specific areas.

There is insufficient prior research on this topic. Many studies look at differences between genders; however, there is limited research on how high school counselors can assist female students specifically, as they advise them on career exploration and college search processes. This study aimed to address the gender gap in STEM fields and what high school counselors can do to decrease that gap.

The purpose of this study relates to three theoretical frameworks, including Bandura's social cognitive theory (1986), Holland's career theory (1959), and Lorber's gender theory (1994). The intersection of these three theories is the foundation of this study.

Theoretical/Conceptual Framework

Bandura's social learning theory (1986) explains human choices and personal development and suggests that people learn based on their surroundings and interpretations. The main principle behind this theory is that individuals learn from experiences within a social context (Smith, 2005). The *social* part of this theory refers to people learning behaviors from conditioning or observing and imitating others (Myers & DeWall, 2018). The *cognitive* part of this theory refers to what people think about a situation affecting our behaviors (Myers & DeWall, 2018). Bandura researched people and made observations that suggested people learn behavior from their environment using observations that encompass environmental and cognitive factors that interact to influence human behavior (McLeod, 2016). Bandura's work relates to this study as it examines how people choose different schools and career environments (Myers & DeWall, 2018). Students interested in learning more about STEM areas may choose to pursue STEM majors in college and possibly careers in the STEM field. Self-efficacy refers to one's sense of competence and effectiveness (Myers & DeWall, 2018), a person's sense of his or her ability (Gray, 2011), or beliefs in one's ability to successfully perform specific behaviors (Sheu et al., 2009). Self-efficacy influences behaviors and environments while being influenced *by* them (Bandura, 1986), which is a central part of this theory (Sheu et al., 2009).

Holland's career theory (1959, 1997) utilizes six themes: Realistic, Investigative, Artistic, Social, Enterprising, and Conventional (Holland, 1959). Students take assessments and specific codes for those six themes are created based on their responses. Holland's codes consist of the top three responses given during the assessment. This theory suggests that people select careers consistent with their personalities (Sheldon et al., 2020). This theory is practical and commonly applied by school counselors when working with their students on career planning (Curry & Milsom, 2017).

Lorber's gender theory (Lorber, 2010) examines feminism's fundamental goal as a social movement to ensure equality between men and women. Lorber addressed gender equality in terms of legal, social, and cultural aspects. She referred to gender balance, which can create equality throughout our society, including domestic responsibilities, access to career opportunities, leadership opportunities, political power, and health care. By encouraging more females to pursue STEM fields, *gender balancing* is an achievable goal. This gender theory relates closely to this study as the research focused on gender divisions in academic and professional realms.

The present research fits within the theoretical framework. Several studies utilize Bandura's social cognitive theory (1986), Holland's career theory (1959), and Lorber's gender theory (1994) as frameworks for their research, similar to the current study. Many researchers look to self-efficacy as a frame for their studies. Falco (2017) suggested that one reason to explain this gap is the possible correlation between lower self-confidence in STEM subjects and low level of STEM career self-efficacy relating to STEM-related educational and professional aspirations.

Grossman and Porche (2014) explained that encouraging students to pursue STEM studies is critical to developing students' STEM self-efficacy throughout high school. Cabell et al. (2021) looked at social cognitive theory and students' self-efficacy, similar to the current study. They suggested that during their high school years, students should have opportunities to participate in high-level STEM coursework and increase self-efficacy in their STEM skills and abilities. Tam et al. (2020) explored students' self-efficacy as a framework for information communications technology (ICT) education. Davison et al. (2014) suggested that academic preparation and self-efficacy utilize Hackett's social-cognitive career theory. Martinez et al. (2021) explored counselor self-efficacy in their study. Murcia et al. (2020) examined children who decided to pursue STEM studies, specifically looking at the impact of the learning environment on students' STEM career interests and self-efficacy. Brookover (2021) studied research focused on developing school counselors' roles in students' STEM self-efficacy and pursuing postsecondary STEM education. Mohtar et al. (2019) also examined Social cognitive career theory's (SCCT) factors that influence students' interests in STEM careers.

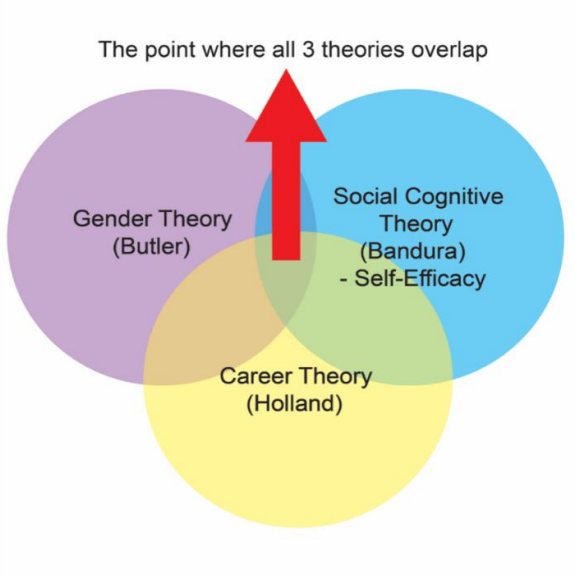
Other researchers look to Holland's career theory as a framework for their studies. Sheldon et al. (2020) suggested that Holland's career theory and system are evident in the training of career counselors. Counselors' training includes working with students to match their personalities with potential career opportunities. This theory is utilized modernly in school settings, suggesting that people should pursue career paths that align with their personalities (Sheldon et al., 2020). School counselors facilitate career and college exploration with their students (Curry & Milson, 2017). They often refer to Holland's career theory as a guide for career planning (Zainudin, 2019). This theory is

practical and commonly applied by school counselors when working with their students on career planning (Curry & Milsom, 2017). This theory is commonly used with adolescents and adults (Curry & Milson, 2017). Mau and Li (2018) suggested looking at younger adults as a time of exploring and establishing careers, similar to the current study. Research conducted by Lorber and Farrell (1991) investigated the social construction of gender, which explained a feminist understanding of the systemic aspects of women's roles in society, and integrated empirical research to demonstrate this in daily lives and activities. Andersson et al. (2009) looked at teachers' understandings regarding gender and how they think about gender issues in the classroom, specifically relating to science education. They explored how introducing gender theory might change this awareness, utilizing it as a guide to their research.

The researcher used these theoretical frameworks to analyze and interpret the research. Bandura's social cognitive theory (1986), which explains human choices, relates to students selecting STEM areas to pursue academically and professionally. Students' interest in and selection of specific STEM areas can allow for individualized college and career planning with their school counselor throughout high school. Holland's career theory (1959) suggests that people select careers aligned with their personalities (Sheldon et al., 2020). High school students in each school in this study participate in career assessments that culminate in their Holland codes (Naviance), which can be used when working with school counselors on college and career exploration activities. Lorber's gender theory (1994) aims for gender balance, which the researcher addressed throughout the data collection process. The foundation of this study is the point where the three theories overlap, and the focus of each theory is related to the others.

Figure 1

Conceptual Framework



The intersection of the three theories is the foundation of this study. The researcher used these theoretical viewpoints to develop the interview protocol and survey questions.

Significance of the Study

The present research relates to professional standards outlined by the American School Counselor Association (ASCA) and the Council for Accreditation of Counseling and Related Education Programs (CACREP), which provide standards for institutions to abide by when training counselors. Girls Who Code is an advocacy group aimed at closing the gender gap in technology and creating a more balanced technology industry.

American School Counselor Association

The present study is related to professional standards and competencies as suggested by the American School Counselor Association (ASCA), which are to be followed by school counselors across the United States when working with pre-

kindergarten through 12th-grade students. These standards and competencies address the domains of academic achievement, career planning, and social/emotional development. This study focused on the career planning domain, focusing on college exploration. ASCA is a professional organization supporting school counselors as they help students with academic, career, and social/emotional development so students may achieve success in school and after (ASCA, 2023).

The school counseling profession originated as vocational guidance in the early 1900s (Gysbers, 2010). The field has expanded to include social/emotional, academic achievement, career planning, and college advising. However, vocational guidance is still a significant focus of the school counselor's role (U.S. Bureau of Labor Statistics, 2020). Many school counselors, especially those working with high school students, help their students prepare for college and careers (ASCA, 2019). According to ASCA (2019), "high school counseling programs are essential for students to achieve optimal personal growth, acquire positive social skills and values, set informed career goals and realize their full academic potential to become productive, contributing members of the world community" (p. 2). School counselors must receive training while they are in college and after, as well as when working, as professional development in vocational counseling to assist students with career exploration (Karahan, 2021). Previous research demonstrated that school counselors do not feel knowledgeable about STEM careers and want to learn more about those areas (Cabell et al., 2021; Hall et al., 2011), which the researcher examined during this study.

According to ASCA, a critical responsibility of high school counselors is to plan for postsecondary options, which was the focus of this study. The ASCA model states

that school counselors provide all students with equal academic, career, and social/emotional development opportunities (ASCA, 2019). This study looked specifically at female students who pursue STEM majors in college. Murcia (2020) discussed specific aspects of career planning that school counselors perform, including course selection, promoting academic rigor, and providing specific attention to under-represented groups. Super (1980) suggested that the goal of career planning is to select a career that can create a future where individuals will be happy.

> ASCA's ethical standards state a responsibility for school counselors to: identify and examine gaps in college and career access and address both intentional and unintentional biases in postsecondary and career counseling; provide opportunities for all students to develop a positive attitude toward learning, effective learning strategies, self-management and social skills, and an understanding that lifelong learning is part of long-term career success; and address any inequitable systemic policies and practices related to students' postsecondary choices (ASCA, 2022).

Regarding marginalized populations, an ethical standard for school counselors is to "actively advocate for systemic and other changes needed for equitable participation and outcomes in educational programs when disproportionately exists regarding enrollment in such programs by race, gender identity, gender expression, sexual orientation" (ASCA, 2022). The marginalized population examined in this study was female students pursuing STEM majors in college.

Council for Accreditation of Counseling and Related Education Programs

The Council for Accreditation of Counseling and Related Education Programs (CACREP) provides standards for institutions to abide by when training counselors. These standards produce highly skilled counselors who perform best practices based on their intense standards-based training programs (CACREP, 2023). CACREP's contextual dimensions include the school counselors' roles relating to college and career readiness, using developmentally appropriate career counseling interventions and assessments, strategies to facilitate school and postsecondary transitions, and interventions to promote college and career readiness (CACREP, 2022). School counselors must receive proper training to support their students in these specific domains, all of which relate to the purpose of the current study.

Girls Who Code

Girls Who Code is an organization aiming to close the gender gap in technology and create a more balanced technology industry. They offer programs to young women from elementary school through college, including an alumnae network. Their data shows that alumnae of their programs major in computer-science-related fields 15 times more than the national average, and their Black, Latina, and low-income alumnae major in computer-science-related fields more than 16 times the national average. Their programs provide young women with a support system and a feeling of belonging so they can persist, thrive, and lead in the technology industry (Girls Who Code 2019 Alumni Data Report, 2019).

Girls Who Code advocates for lawmakers to create educational policies to attract girls in grades kindergarten through 12 to computer science and retain them so they

pursue careers in the field (Girls Who Code 2019 Alumni data report). Some of those policies include tracking and reporting data on computer science participation, increasing exposure to females and underrepresented groups in technology, funding gender inclusion training for educators as professional development opportunities, and expanding computer science courses to younger students (Girls Who Code 2019 Alumni data report). Educators have reformed engineering curricula to attract more females to the field by promoting girls' interest in math and science. These efforts have worked to encourage females to study these areas. However, a gap still exists in that many females quit these fields during and after school (Silbey, 2016), which the researcher explored in this study.

An important social policy issue is the female shortage in pursuing STEM majors (U.S. Department of Commerce, 2012). There is a gender gap in the United States regarding females who study STEM-related majors in college, have careers in STEM fields, and are leaders in STEM fields. There is an underrepresentation of females in these areas compared to males (Legewie & DiPrete, 2014). According to Beede (2011), women hold disproportionately fewer STEM undergraduate degrees, specifically engineering. Sector (2017) found a decrease among females in STEM as their levels of education increased. That downward trend is also evident in the workforce among STEM professions (Glass et al., 2013). Legewie and DiPrete (2014) suggested that this gender gap may negatively impact the supply of qualified labor in science and engineering occupations and addressed a gender gap in earnings. Fleming (2018) noted that males working in the science and engineering fields earn one-fifth more money than females, suggesting a financial gender disparity. The National Science Foundation has prioritized

STEM education and research in schools serving low-income populations, specifically to address race, class, and gender inequalities (Ferrini-Mundy, 2013).

This study is significant in that results can improve the practice of high school counselors as they work with female students in their quest to study STEM majors in college and work in a STEM field in their future careers. According to the American School Counselor Association (ASCA), a significant role of high school counselors is to plan for postsecondary options, which was a focus of this study. The ASCA model states that school counselors provide all students equal academic, career, and social/emotional development opportunities (ASCA, 2019). Royster et al. (2015) referred to school counselors as "brokers" (p. 219) who connect students with academic and extracurricular activities while addressing individual students' needs. School counselors must continue to learn and grow (Harmon et al., 2021) to best help their students currently and in the future. Counselors hold substantial roles in developing the future workforce (Zainudin et al., 2019). This study focused on female students who pursue STEM majors in college.

This gender gap has decreased in recent years as the number of women studying STEM fields has increased. Specifically, the number of science and engineering degrees earned by women from 2011 to 2020 increased by 63% at the associate's level, 34% at the bachelor's level, 45% at the master's level, and 18% at the doctorate level. In 2020, women earned 66% of bachelor's, 67% of master's, and 60% of doctoral degrees in the social and behavioral science areas. (National Science Foundation, 2023). Highly trained school counselors can continue to work with their female students to continue this trend.

The currently existing research is insufficient in terms of looking at the gender gap among female STEM students using the theoretical perspectives of Bandura's social

cognitive theory (1986), Holland's career theory (1959), and Lorber's gender theory (1994). The intersection of these three theories is the focus of this study. No studies use more than one of these theories at a time. No interview protocol exists that gathers high school counselors' perspectives on the female gender gap in STEM fields. For this study, the researcher created interview questions that three school counselors not involved in this study field-tested to review each item and provide feedback to the researcher.

This study will contribute to the school counseling field by overcoming the shortcomings of existing studies. The researcher combined these theories to guide the current study. The goal of this study was to provide support to school counselors working with female students interested in STEM fields, which will contribute to the counseling field to better help counselors in the future.

Connection with Social Justice and Vincentian Mission in Education

The research is related to St. John's University's mission in addressing an issue of social justice for females, a historically underrepresented group in the STEM fields. Education is essential to upward mobility in our culture (Harmon et al., 2021). Falco (2017) suggested that STEM jobs earn the highest salaries and have the most significant growth potential over the next century, opening opportunities for many to succeed. STEM workers have higher median earnings (NCES, 2020) and lower rates of joblessness than non-STEM workers (National Science Foundation, 2023), allowing those professionals to succeed and prosper in our society. Specifically, those employed in science and engineering careers tend to have higher wages and lower unemployment rates (Martinez et al., 2021). A gender disparity exists among STEM fields. In 2020, females earned lower average salaries than males in science, engineering, engineering-related, and

middle-skill occupations (National Science Foundation, 2023). This study aimed to assist school counselors in their work with students on career and college counseling to decrease this gender gap.

According to Sherman-Morris (2019), school counselors can act as vital "social agents" (p. 447) for students to expand their social capital. When students do not have resources available at home from their parents or others, they rely on their high school counselors for academic, college, and career support (Sherman-Morris, 2019). Highly trained school counselors who provide quality career and college counseling have crucial roles in their students' decisions to pursue STEM studies (Nikischer, 2016). The National Office for School Counselor Advocacy (NOSCA) found that counselors play a vital gatekeeping role in postsecondary degree attainment and the students to whom they provide career counseling services (College Board, 2010).

Research Design and Research Questions

The research design of this current study is a multi-case study. This design was selected so that multiple cases can each provide different individual perspectives on the same issue (Creswell & Poth, 2016). The researcher investigated and explored seven real-life cases over time through detailed, in-depth multiple sources of data collection, which, after data was analyzed, resulted in descriptions and themes. (Creswell & Poth, 2016). These cases will be compared and contrasted (Bogdan & Biklen, 2016). The sample included seven current high school counselors who work in four public high schools outside New York City. Two high schools are in the same school district, and the others are in separate school districts.

The data collection methods for this multi-case study included in-depth, semi-structured in-person interviews, collection of field notes, collection of artifacts, and online surveys of current high school counselors who work with students on career exploration and college preparation. The researcher initially included observations of participants as a method of data collection. Due to scheduling constraints, it was not feasible for those to occur.

The setting of this study is a suburban region outside of New York City. The four public high schools represented consist of various socioeconomic statuses. Two high schools are in the same school district, and the other two are in separate school districts. The areas will include various socioeconomic levels. The researcher used the number of students in each district receiving free/reduced lunch to explain economic disadvantage. Each high school had students aged 14 to 19 and were in grades 9 through 12.

The sample of this study included seven high school counselors. They were purposely selected to carefully represent their specific voices and opinions (Vogt et al., 2012). Creswell and Poth (2016) explained that effective data collection arises from purposeful sampling, which generates data to allow the researcher to examine the problem. The participants included seven public high school counselors from four suburban school districts outside New York City. Participants and school districts were assigned pseudonyms as a method of identification to remain anonymous. Demographic information, including each participant's characteristics, including age, gender, ethnicity, job title, education level, years in current school, and years in profession, was collected prior to data collection. The employment context for each participant, including the number of students in their caseload, school size, and percentage of students receiving

free/reduced lunch, was collected prior to data collection (Martinez et al., 2021).

Research Questions

1. What are the perspectives of high school counselors on encouraging female students to explore STEM fields to study in college?
2. What processes do high school counselors apply to these female students, specifically relating to college advising? What are the strengths and weaknesses of these processes? What specific methods can be employed by high school counselors?
3. How can these practices be improved so that school counselors can provide better support for their students?

Definition of Terms

American School Counselor Association (ASCA) - the professional association of school counselors that

> "supports school counselors' efforts to help students focus on academic, career and social/emotional development so they achieve success in school and are prepared to lead fulfilling lives as responsible members of society. ASCA provides professional development, publications and other resources, research, and advocacy to school counselors around the globe" (ASCA, https://www.schoolcounselor.org/About-ASCA, 2023)

Council for Accreditation of Counseling and Related Educational Programs (CACREP) – "the leading national accrediting body for Professional Counselor preparation programs" (CACREP, https://www.cacrep.org/wp-content/uploads/2023/02/CACREP-1-Page-Flyer.pdf, 2023)

Gender – "The behavioral, cultural, or psychological traits typically associated with one sex" (www.merriam-webster.com, 2023)

Naviance – a career and college-readiness online program used in K-12 schools

School Profile – A document compiled by each high school submitted with students' transcripts to "be comprehensive and accurately portray the uniqueness" of each high school. (https://counselors.collegeboard.org/counseling/advising/school-profiles/create, 2023)

Sex – "The sum of the structural, functional, and sometimes behavioral characteristics of organisms that distinguish males and females" (www.merriam-webster.com, 2023)

Sex and Gender

The terms sex and gender are often used interchangeably in our culture. For this study, the researcher explored gender and its role in STEM. The terms sex and gender are often used interchangeably in many studies to distinguish between men and women. Riddell and Tett (2010) suggested that sex can be used to explain a biological category, referring to physical differences between men and women. They explain that gender can be used to explain how sexual identity is constructed, which can vary greatly between men and women. This study will use the term gender when addressing the difference between males and females.

STEM - Science, technology, engineering, and mathematics

CHAPTER 2

Introduction

The following literature review includes related articles that guided this study. The researcher addressed the gender gap in STEM fields and how school counselors can assist their female students interested in pursuing STEM interests throughout the review. The researcher included three theoretical frameworks in this chapter: Bandura's social cognitive theory (1986), Holland's career theory (1959), and Lorber's gender theory (1994). The intersection of these three theories is the foundation of this study. The literature review focused on STEM majors, STEM careers, and school counselors' impact on STEM majors and careers.

There has been substantial research on both the gender gap in STEM majors and careers and school counselors' work with their students on college planning and career exploration. The current literature supports the concept that there is a gender gap in STEM studies and careers, and school counselors can assist their female students interested in pursuing careers based on their interests. However, there is a gap in the literature exploring how specifically school counselors can work with their female students to pursue STEM majors and careers, eventually shrinking the gender gap in STEM fields.

This chapter relates to the previous chapter as these three theories guided the entire study. The purpose of this study was to explore how high school counselors influence the choices of STEM majors for female students, and all subsequent research is based on these three theories individually. The central focus of this study is the synthesis of where the three theories meet. This chapter relates to subsequent chapters as it

provides the basis for the entire study. The methodology, research design, research questions, methods, procedures, findings, and discussion connect to these three theories.

Theoretical Framework

Three theoretical perspectives guided this study. Those theories are Bandura's social cognitive theory (1986), Holland's career theory (1959), and Lorber's gender theory (1994). The intersection of these three theories is the focus of this study. The researcher used these theoretical viewpoints to develop the interview protocol and survey questions. This study combined these theoretical frameworks to analyze the perceptions held by school counselors when working with their female students interested in pursuing STEM majors in college.

Social Cognitive Theory and Self-Efficacy

Albert Bandura's social cognitive theory (1986, 1997) explains human choices and personal development and suggests that people learn from their environments and interpretations (1997). The main principle behind this theory suggests that people do not thoughtlessly respond to their environment but actively interact with their surroundings by looking for and acting upon information (Bandura, 1997). Bandura researched people and observations and suggested that people learn their behaviors from the environment through observations and that environmental and cognitive factors interact to influence human behavior (McLeod, 2016). The *social* part of this theory refers to people learning behaviors through conditioning or observing and imitating others (Myers & DeWall, 2018). The *cognitive* component of this theory refers to what people think about a situation affecting our behaviors (Myers & DeWall, 2018). Self-efficacy influences behaviors and environments while also being influenced by them (Bandura, 1997), which

is a central part of this theory (Sheu et al., 2009). Bandura (1997) suggested that people interact with their environment, contribute to it, and decide their outcomes. Bandura proposed the interaction of our traits with our circumstances (Myers & DeWall, 2018). Individuals and their situations can be compared to nature and nurture working together (Myers & DeWall, 2018).

This theory focuses on how people and their environment interact, meaning how we interpret and respond to external events and how our schemas, memories, and expectations influence our behavior patterns (Myers & DeWall, 2018). This theory aligns with other vocational psychology research (Betz & Hackett, 1981; Hackett & Betz, 1981) through its ability to explain important aspects of career behavior, including female underrepresentation in male-dominated career fields, linking this theory to this study.

This theory relates to the current study in that people choose their environments, and in this study, students choose STEM majors and careers. Relating Bandura's work to this study, people choose different environments. People select their environments, which shapes us (Myers & DeWall, 2018). Students interested in learning more about STEM areas choose to pursue STEM majors in college and possibly careers in the STEM field.

Self-efficacy refers to one's sense of competence and effectiveness (Myers & DeWall, 2018), a person's sense of their abilities (Gray, 2011), or beliefs in their ability to successfully perform specific behaviors (Sheu et al., 2009). Sheu et al. (2009) suggested that people develop an interest in a behavioral activity when they hold favorable beliefs about their performance capabilities and the likely outcomes of participating in this activity. Conversely, they suggest that a dislike for a particular activity should result when people seriously doubt their capabilities and when they

anticipate negative outcomes relating to this behavior (Sheu et al., 2009). Students' academic self-efficacy, meaning their confidence that they may be successful in a subject, can predict academic achievement (Myers & DeWall, 2018).

Self-efficacy can be described as people's beliefs about their abilities to perform specific tasks. People who expect that they can perform a task have high self-efficacy about that task, and people who expect that they cannot successfully have low self-efficacy about that task (Gray, 2011). An example of a student having high science self-efficacy is when students believe they can achieve their science goals through their abilities and actions (Brookover, 2021).

Bandura suggested that there is no simple connection between self-efficacy and good performance, but it is also a cause of good performance (Gray, 2011). Students with strong self-efficacy are more likely to set goals and create adaptive learning environments (Bandura, 1997). He explained that those who had higher self-efficacy in specific areas of their behavior were more likely to set higher goals, have a stronger commitment to their goals, be more motivated, resilient, and persevere, and would eventually be more likely to achieve higher goals that they set (Bandura, 1986). Bandura's work suggests that people gain their self-efficacy beliefs from four sources: interpretations of actual performances, modeled experiences, social/verbal persuasion, and emotional arousal (1997). Grossman and Porche (2014) explained that throughout high school, encouraging students to pursue STEM studies is critical to developing students' STEM self-efficacy. This relates to the current study, as it offers an approach that accurately reflects how students make their decisions in this study relating to selecting STEM majors.

Career Theory

Holland's career theory (Sheldon et al., 2020) uses six themes, "Realistic, Investigative, Artistic, Social, Enterprising and Conventional" (p. 28). Students take assessments and according to their responses, the creation of specific codes for those six themes occurs. Holland codes consist of the top three responses given during the assessment. Counselors can work with students to interpret their results and match those with specific careers (Sheldon et al., 2020). Holland based his theory on the premise that personality factors underlie career choices. Holland said that strong person-environment matches result from job success and satisfaction (Curry & Milsom, 2017). He developed a classification system based on personality types to categorize people and occupations. His theory suggests that for people to be successful and satisfied, they should choose an occupation compatible with their personality (Curry & Milson, 2017). People pursuing career paths that align with their Holland codes tend to perform better and be more satisfied (Sheldon et al., 2020).

Holland based the six vocational types on a specific combination of interests, skills, and dispositions (Sheldon et al., 2020). The six personality types are "Realistic, Investigative, Artistic, Social, Enterprising, and Conventional" (p. 28). The six types can be distinct, coexist, and overlap (Sheldon et al., 2020). When taking the survey, participants indicate which activities they like, and the most selected activities result in specific three-letter codes (Sheldon et al., 2020). Realistic personalities typically focus on concrete and physical activities (Curry & Milson, 2017). Realistic careers include cook, farmer, firefighter, painter, auto mechanic, and electrician (Curry & Milson, 2017; Sheldon et al., 2020). Examples of realistic activities include building things, working

with tools, and repairing cars (Sheldon et al., 2020). Investigative personalities interact with the environment through their intellect, using concepts and words (Curry & Milson, 2017). Investigative careers include chemist, psychiatrist, geneticist, mathematician, and biomedical engineer (Curry & Milson, 2017; Sheldon et al., 2020). Examples of investigative activities include developing a research study and working on a scientific project (Curry & Milson, 2017; Sheldon et al., 2020). Artistic personalities are creative, engaging in activities, including art and drama, and expressing themselves (Curry & Milson, 2017). Artistic careers include actor, artist, graphic designer, choreographer, and journalist (Curry & Milson, 2017; Sheldon et al., 2020). Examples of artistic activities include playing a musical instrument and writing novels or plays (Sheldon et al., 2020). Social personalities use their interpersonal skills to interact with the environment (Curry & Milson, 2017). Social careers include nurse, dental hygienist, psychologist, counselor, teacher, speech therapist, social worker, religious worker, and physical therapist (Curry & Milson, 2017; Sheldon et al., 2020). Examples of social activities include taking a human relations course and working as a volunteer (Sheldon et al., 2020). Enterprising personalities use their persuasive skills, demonstrate dominance and power over others, and enjoy being recognized for their efforts (Curry & Milson, 2017). Enterprising careers include lawyer, sales manager, human resources representative, sports promoter, producer, buyer, and urban planner (Curry & Milson, 2017; Sheldon et al., 2020). Examples of enterprising activities include starting your own business and promoting a product (Sheldon et al., 2020). Conventional personalities typically enjoy receiving approval from others; their behaviors are routine (Curry & Milson, 2017). Conventional careers include statistician, librarian, logistics analyst, bookkeeper, financial analyst, and

accountant (Curry & Milson, 2017; Sheldon et al., 2020). Examples of conventional activities include organizing meetings and working in an office (Sheldon et al., 2020).

This theory is currently used in school settings, suggesting that people should pursue career paths that align with their personalities (Sheldon et al., 2020). School counselors facilitate career and college exploration activities with their students (Curry & Milson, 2017). They refer to Holland's Career Theory as a guide to assist with career planning (Zainudin, 2019). This theory is practical and commonly applied by school counselors when working with their students on career planning (Curry & Milsom, 2017). This theory is commonly used by adolescents and adults (Curry & Milson, 2017). These factors explain how this theory is significant to the current study. All seven participants in the current study utilize Holland's themes with their students, specifically regarding college planning and career exploration tasks.

Many school counselors use Naviance, a computer-based program for college and career planning. Naviance utilizes Holland's career theory in its Career Interest Profiler (Naviance, 2023). Students fill out a 15-minute online assessment of 60 questions, which yields results based on students' interests that show Holland's six personality traits, which aid in career exploration and planning. The assessment links those traits to career aspirations and educational opportunities based on each student's personality. Students, parents, teachers, and school counselors can access and utilize these results in career and college planning (Naviance, 2023). All seven participants in the current study use Naviance as a resource when working with their students on college planning and career exploration.

Gender Theory

Judith Lorber's gender theory (Lorber, 1994) suggests that we completely remove gender divisions in society since men and women are not truly equal in our society (Lorber, 2000). Lorber (2000) provides examples of gender divisions embedded in our culture, including our sense of ourselves and our interactions with "families, work organizations, political entities, legal and medical systems, religions, and high and popular culture" (p. 80). Lorber and Farrell (1991) explored the social construction of gender, including a feminist understanding of the impact of gender on roles in society.

For this study, the researcher focused on gender divisions in academic and professional realms relating to STEM areas. There are many other gender theories; however, this gender theory relates closely to the current study.

Lorber (2000) suggested that although women's status in the Western world has improved vastly over the past 150 years, gender divisions still exist (2000). To end this division, Lorber calls for a feminist degendering movement to eradicate this distinction. Lorber (2000) stated that "racial, ethnic, class and sexual divisions have been significantly challenged" (p. 80), but our society still allows for gender divisions. Lorber (2000) said that biology created two genders, male and female, which is a way to separate people into two different and distinct categories.

Lorber (2000) claimed that simply categorizing gender into boys and girls and men and women creates a structure of division into two categories, forming a structural conceptualization. Differences in behavior, attitudes, emotions, and expectations divide the two groups. For this study, the researcher focused on gender differences related to gendered work roles, specifically related to STEM majors and career paths. These binary

divisions are deeply embedded into our society and social organizations. She suggested that our culture should develop strategies to remove the gendered division of labor in all aspects, including workplaces. As a strategy, she urged society to change values and attitudes to create institutionalized changes to the gendered structure of personal and professional areas.

Lorber (2000) aims to make gender irrelevant. Lorber (2000) suggested a movement to rebel against the division of the two genders. Previous research and feminist movements have aided in resisting and reshaping these divisions but have not changed the underlying structure of society. Lorber (2000) suggests degendering strategies to remove these distinctions completely. She aims to have men and women viewed equally in all areas.

Lorber's theory (Lorber, 2010) looks to feminism's primary goal as a social movement to have equality between men and women. Lorber addresses gender equality in terms of legal, social, and cultural aspects. She stated that men receive higher pay than women for comparable work, and often, men move up career ladders faster. An article by Welsch and Winden (2019) and reviewed in this study also addressed those points. Lorber (2000) explained that women carry children and are often primary caregivers, which may impact their professional roles. Lorber suggested that gender balancing can assist in this inequality. The goal of gender balance is to find equality throughout our society, including domestic responsibilities, access to career opportunities, leadership opportunities, political power, and health care.

Review of Related Literature

The literature review is organized by placing articles into four subsections, including critical timing of adolescence, STEM majors, STEM careers, and school counselor impact on STEM majors and careers. The articles in the subsection on the critical timing of adolescence address that high school years are critical in college and career exploration. The articles in the subsection on STEM majors include topics such as the selection of STEM as a major, the number of females choosing STEM majors, the timing of selecting majors, racial and gender differences among STEM majors, and gender segregation among STEM majors. The articles relating to the subsection of STEM careers include topics such as science education and gender issues, the increase in females studying STEM majors yet not pursuing careers in STEM areas, factors that influence STEM career aspirations of high school students, access to counseling and STEM careers; the lack of participation in STEM careers globally, and influences on career advising. The articles relating to the subsection of school counselor impact on STEM majors and careers include the impact of school counselors, school counselors' role in college advisement, school counselors' role in career planning, and school counselor training. Each article related to the current study, whether focusing on school counselors, STEM majors, and STEM careers.

The researcher conducted all searches for articles independently utilizing electronic databases, including Google Scholar, EBSCOhost, and ProQuest Central. Keywords used include STEM major, STEM career, STEM gender gap, females in STEM, school counselor role, high school counselor and career planning, and school counselor and college advising. The results were expansive, and often, the researcher

excluded articles that did not address these specific majors and careers and this specific age group of students. Included articles addressed the roles of high school counselors. Excluded articles included elementary and middle school counselor roles. The researcher included articles that addressed STEM majors in college and excluded articles that address graduate degree programs.

Critical Timing of Adolescence

In a phenomenological study conducted by Cabell et al. (2021), the researchers' purpose was to contribute to previously conducted literature surrounding high school counselors and how to support underrepresented students who are interested in STEM fields. They aimed to explore the influence of context on school counseling, specifically during the COVID-19 pandemic. This article relates to the current study, focusing on high school counselors and students. The researchers pointed to a lack of diversity in STEM fields in the United States and provided clear, relevant, and timely data to support this. They addressed the importance of diversity in the STEM workforce and the need to increase multiple perspectives brought out from diversity.

Cabell et al. (2021) addressed the significance of the timing of high school as a critical time for addressing gender and racial discrepancies in STEM interests. They looked at social cognitive theory and students' self-efficacy, which relates to the current study. Cabell et al. (2021) suggested that during high school years, students are provided with "an opportunity to engage in higher-level STEM coursework and gain self-efficacy in their STEM skills and abilities" (p. 144). Cabell et al. (2021) addressed stereotype threat, explaining that girls and underrepresented minorities are more likely to feel anxious "about their performance or ability based on negative stereotypes" (p. 144),

resulting in decreased enrollment in advanced STEM classes during high school. This decrease results in "gaps in advanced STEM skills and a lack of further interest in STEM careers" (Cabell et al., 2021, p. 144), and ultimately, the gender gap in STEM careers that the current study is exploring. The researchers suggested that high school is often students' last opportunity to develop and cultivate their interest in STEM careers, and high school counselors can provide interventions and support to their students.

Cabell et al.'s (2021) review of previous literature supports their study on the significance of high school being a critical time and school counselors playing a significant role in STEM interests directly related to the current study, as the researchers selected high school counselors as participants. They pointed to previous studies that addressed the school counselor's role specific to STEM areas. They specifically addressed school counselors and their roles in working with girls and other underrepresented racial minorities, suggesting that school counselors should be aware of opportunity gaps in STEM to support these students. Their research also addressed the importance of school counselors collaborating with parents and other stakeholders as they are leaders in the school system. They examined the counselors' needs to understand barriers and challenges and ways to help students explore STEM career aspirations for these students despite those challenges.

Cabell et al. (2021) also explored the COVID-19 pandemic and how it highlighted inequalities within our education system. They investigated a digital equity gap, traumatic experiences, and social-emotional struggles that school counselors can focus on in their roles to develop and motivate students interested in STEM areas.

The purpose of Cabell et al.'s (2021) qualitative study was to increase understanding of the lived purpose of this transcendental phenomenological study and to "increase understanding of the lived experiences of high school counselors who support girls' and underrepresented minority students' interests in STEM" (p. 146). They also aimed to address the influence of the COVID-19 pandemic on high school counselors' support of these students in their STEM interests and career aspirations. The purpose of the current study was to gather multiple perspectives from current high school counselors, similar to this article.

Cabell et al. (2021) used purposeful sampling and recruited nine counselors to participate in this study. They included ages from 26 to 46, seven females and two males; six identified as Black, two as White, and one as Mexican American/Chicano. They worked in various states throughout their careers, including California, Virginia, Indiana, Maryland, Michigan, Washington D.C., Kansas, and Missouri. Three worked in private high schools, and six worked in public high schools. Cabell et al. (2021) demonstrated this information in a table.

First, they received IRB approval to begin their study. They sent recruitment flyers on social media and to national school counseling listservs to recruit participants. All interviews were conducted on Zoom and lasted from 30 to 45 minutes. They were each audio-recorded and transcribed. They included their interview protocol in the Appendix. Participants reviewed each transcript as member checking. These methods are similar to the current study.

The researchers analyzed the data from the transcripts. The researchers examined the raw data to note significant quotes, and then clusters of meanings were developed into

themes. They used these themes to develop descriptions of each participant's experiences and explain how contextual factors may have influenced their support of these students in their STEM career interests and aspirations.

Their results yielded four themes that emerged from the data collection. The themes included professional knowledge surrounding issues of diversity in STEM, training related to the needs of underrepresented students in STEM, active engagement in supporting underrepresented students' STEM career interests, and barriers (including COVID-19, school, administration, students' self-efficacy, and language) related to supporting underrepresented students' STEM interests. Their results emphasized the importance of school counselors' roles to promote, encourage, and support girls and underrepresented minorities interested in STEM careers.

Cabell et al. (2021) conducted this research during the COVID-19 pandemic, so implications included (a) how school counselors can support underrepresented students' STEM interests, particularly during the COVID-19 pandemic; (b) how counselor educators can contribute to STEM-related research and training; and (c) how school administrators can support school counselors' STEM initiatives (p. 155). They addressed the need for training related to STEM professions. However, schools lacked this training. They also pointed out the issue of not having enough time to dedicate to discussing STEM career paths with students individually. They suggest that career development assessments are vital for counselors to support their students.

Legewie and DiPrete (2014) conducted a quantitative study focused on the role of the high school context as the time for the most impact on STEM interest. Legewie and DiPrete (2014) suggested that the STEM gender gap differs based on "pre–high school

performance, math, and science interest, and aspirations for a STEM career" (p. 260). They suggested that schools have a significant role in students' interest in STEM fields, and they looked specifically at math and science curricula in high school and gender segregation of extracurricular activities in high school. This article also relates to the current study, focusing on high school counselors and students.

Legewie and DiPrete (2014) did not include a substantial literature review in this article. However, they did point to previous research on the gender gap in STEM. They addressed sociological and social psychological research focusing on stereotypes, gender beliefs, and social norms. They addressed implications for housework, childrearing, occupational selection, and career trajectories. They shared that gender differences may impact family plans and life goals that influence values, and can be associated with the division of labor within families.

Legewie and DiPrete (2014) looked at the expectation states theory to explain existing gender stereotypes and included status beliefs that attach value to specific skills to the advantaged status. This theory relates to self-esteem, self-efficacy, and career choice based on those aspects. They said gender biases within self-assessment impact career interests and expectations.

Legewie and DiPrete (2014) provided clear and in-depth descriptions of their data, analysis, and findings. They used data from the National Education Longitudinal Study (2002), which contained interviews with students in 1988. The study followed students until they graduated from high school in 2000. They also made two separate samples and included students' "plans to major in STEM fields at the end of high school as the principal outcome variable" (p. 263). Overall, their three samples included 11,270

students, 9,120 students, and 2,350 students. They looked at this data for each group and found "large variations in the ability of high schools to attract students to STEM fields" (Legewie & DiPrete, 2014, p. 264).

Legewie and DiPrete's (2014) first step was to "estimate the overall impact of high schools on the development of intentions to study science and engineering at the end of high school" (p. 260). Then, they estimated "the causal effect of gender segregation of extracurricular activities and schools' STEM curriculum as two concrete high school characteristics" (p. 264). Next, they estimated the impact high schools have on plans to major in STEM. Their outcome variable was plans to major in STEM fields. The high school treatment indicators were math and science curriculum and gender segregation. Their pre-high school control variables included gender, race, region, occupational aspirations, test scores, grade point average, math/science interest, math/science usefulness, math/science extracurricular activities, and middle school variables. They provided tables and charts that depicted clear descriptions of variables and results.

Legewie and DiPrete (2014) estimated the effect of the strength of high schools' math and science programs. Their results show a significant positive effect of the curriculum index on females' intentions to major in STEM fields but not males. Specifically, they pointed to the estimated effect of 1.16, which suggests that a one standard deviation change in the curriculum index leads to a 16% increase in the odds that a girl develops intentions to major in STEM fields. Their results also demonstrate that gender segregation of extracurricular activities substantially negatively affects students' intentions to major in STEM for females, but again, not for males. The estimated effect is .72, implying that a one standard deviation change on their gender

segregation scale can lead to a 28% decrease in the odds that females will develop intentions to major in STEM fields. Males were unaffected by this gender segregation. Their results were overall robust and supported their hypotheses. The dependent variable split high school students who plan to major in STEM fields in college from all other students. They found and portrayed considerable empirical support for high school context playing a critical role in differences between females and males in their plans to major in STEM fields.

Legewie and DiPrete (2014) discussed implications for policymakers due to the impact they discovered of the local environments having substantial roles in strengthening and weakening gender stereotypes. They addressed the importance of programs such as Head Start to support students outside of school. The researchers discussed future implications for gender trends in STEM professions. Similar to the current study, these researchers stressed the importance of interventions to address the STEM gender gap while students are in high school and planning for their future college and careers.

Legewie and DiPrete (2014) found empirical support for their argument that the high school context does play a substantial role in how gender differences emerge in plans to study STEM fields. Attending a high school that supports females' STEM orientations decreases the gender gap by at least 25%. Another finding shows that high school curriculum in math and science and gender segregation in extracurricular activities significantly impact the gender gap in terms of interest in STEM fields.

Legewie and DiPrete's (2014) results show that women pursue STEM degrees at much lower rates than males. They suggested this gender gap has negative implications

for the supply of qualified labor in science and engineering occupations and noted a gender gap in earnings. Their results show that high school is an influential time in STEM decision-making, relating to the current study and highlighting the importance of working with high school students on career planning.

These articles confirmed that high school and the adolescent years are pivotal in making plans, and it is not too late to pique students' interest in STEM fields. Looking at selecting STEM-specific majors, a large amount of literature addressed includes topics such as the selection of STEM as a major, the number of females choosing STEM majors, the timing of selecting majors, racial and gender differences among STEM majors, and gender segregation among STEM majors.

STEM Majors

In a qualitative study conducted by Bystydzienski et al. (2015), the researchers aimed to address why fewer women enter college STEM programs than male students. They reported the results of a three-year intervention program developed to stimulate and continue mainly low-income, Hispanic, and African American high school girls' interests in engineering careers. This intervention was part of a seven-year longitudinal study that followed 131 female students from Colorado, Iowa, and Ohio as they graduated from high school and went to college. This article relates to the current study as it examines female STEM majors specifically. The researchers did not refer to any theories as a framework for this study. Although practical, this article did not use any theories to guide it, causing it to lose some credibility.

The Female Recruits Explore Engineering (FREE) and Pathways Project was an after-school program that included 131 high-achieving female students who received

interventions, including participation in guided explorations of engineering in 10th grade, self-initiated engineering projects in 11th grade, and college mentoring in 12th grade. After high school graduation, the researchers collected data on these students for four years. All students had strong academic scores in math and science through ninth grade. School counselors and teachers referred these students to participate. They represented ten high schools from three states.

Bystydzienski et al. (2015) conducted all interviews and observations of the participants throughout the three years of intervention activities. Qualitative data were analyzed using a coded scheme developed from their research questions. This methodology is similar to the current study.

Their results showed that the female students reported knowing little about engineering at the beginning of this study, even though they were all taking college preparatory classes and doing well in advanced math and science courses. Eighteen percent of the participants even remotely considered engineering a possible career choice. Eighty-two percent of the participants reported that they knew little or nothing about engineering, had never met an engineer, did not know what engineers do, and never considered engineering as a field of study or a potential career choice for their future. At the end of the second year, more than half of the participants were seriously considering a career in engineering. During that year, the participants explored engineering in monthly FREE meetings, attended career fairs, met practicing engineers, and visited engineering schools and workplaces. During the second year, they each conducted small-scale engineering projects with mentors, which they enthusiastically described in their interviews. Over the 18 months of the FREE program, 57% of the participants remained,

and 51% of those talked seriously about potentially pursuing a career in engineering, compared to 18% at the beginning of the study. Upon beginning college, 21% of the participants enrolled as engineering majors. Thirty-three percent of the participants selected other STEM majors, including mathematics, computer science, biology, zoology, chemistry, and environmental science. After four years of college, 56% of the women who started college studying engineering graduated with an engineering degree, while 80% of those who studied other STEM majors graduated within those majors. One obstacle to completion for some students included finances. They shared that lack of financial resources kept them from attending a college with an engineering major or, in some cases, attending any college at all. All participants shared that FREE "expanded their knowledge and increased their self-confidence in fields they never expected to enjoy" (p. 93).

The results of Bystydzienski et al.'s (2015) study demonstrated that high school is not too late to introduce engineering to talented students. They looked at research suggesting "intensive efforts to increase interest and proficiency in STEM" (p. 93) fields should start early, in elementary and middle school, and that high school was too late to begin. This FREE study suggested that even older students developed interests and continued pursuing these fields throughout college. An issue that needs further support is that many underrepresented students may need substantial financial resources to pursue engineering in higher education. High school counselors and mentors can assist in sharing financial resources and specific scholarship opportunities. They should encourage students to apply to these majors and inform them about social and academic resources available on college campuses. Counselors should also be aware of the self-doubt and

lack of confidence some of these students' face. They can provide networking opportunities for these students to speak to professionals in the STEM field.

Overall, Bystydzienski et al. (2015), conducted a thorough study. Unfortunately, many participants dropped out during their research, so the sample size decreased. They described this in-depth in their article. Another limitation is that they only looked at students in three states, which is difficult to base generalizations from.

Similarly, in their quantitative study, Mann and DiPrete (2013) explored the continuing gender gap in STEM fields, which relates closely to the current study. The researchers found that previous research did not systematically look at the extent to which theories and explanations for the gender gap are consistent with actual trends. Their study was motivated by wanting to understand how the gender gap in STEM majors has remained stable, even with "changing gender distribution in higher education enrollment and trends in gender-specific" (Mann and DiPrete, 2013, p. 1520) areas, including test scores, life goals, expectations about work-family compatibility, and desires for extrinsic or intrinsic satisfaction. They defined STEM majors as biological science, agricultural sciences, computer sciences, engineering, engineering or science technologies, math and statistics, or physical science subfields.

Their literature review demonstrated a substantial decline in gender segregation in many areas since the 1970s. They addressed gender segregation in fields of study, including attributing that to improved opportunities for women in the labor market and changes in the attractiveness of certain majors. Previous studies looked at high-end math performance to explain this gender segregation. There is evidence to show a gap in verbal test scores that favors female students. Their literature included explanations for how

gender differences in values and preferences relate to the female tendency to choose non-STEM majors.

Mann and DiPrete (2013) provided clear evidence of their methods. They used administrative data and four longitudinal studies to evaluate several well-known explanations for the gender gap that persists in STEM-related fields as they relate to mathematics performance, background, and general life goals. They used more recent and comprehensive data than prior studies to conduct this study. They examined math and reading test scores and related performance measures to see how much of the gender gap they explain and to look for evidence of trends in female major choices when performance measures are constant. They developed an alternative explanation that combines gender differences in preferences with structural differences in the organization of majors.

The researchers connected data from student and parent surveys from four long-term studies. The data from four National Center for Education Statistics longitudinal surveys from 1972, 1982, 1992, and 2004 included approximately 15,640 students. They used the High School and Beyond Longitudinal Study from 1980, 1982, and 1984, which included approximately 13,260 students. They used the National Education Longitudinal Study of 1988, 1990, 1992, and 1994, containing approximately 12,400 students. They used the Education Longitudinal Study from 2002, 2–4, and 2006, including approximately 12,530 students.

Mann and DiPrete (2013) focused on the variables that measured performance in high school, specifically in math and reading classes, coursework, and grades. They included demographic variables such as socioeconomic status, race, and parents' highest

education levels. Results included a decomposition of the gender gap in STEM majors. They found that males with high math scores have a higher propensity to STEM majors than females. They estimated a logistic regression model and computed a regression decomposition to examine the separate effects of test scores and coursework on the decision to major in STEM fields. They estimated odds ratios from the logistic regression for college sophomores that showed higher math scores increased the odds of majoring in STEM fields. They used estimates from parallel logistic regression models for both genders to estimate how much the gender gap would decrease if math and reading test scores were the same. Their results also show trends in the returns to performance and life goals. They constructed a pooled dataset of the three most recent panel studies to see if the relationship between test scores, life goals, and the STEM majors' gender gap has changed in the past 30 years. This model provided evidence to conclude that males are more likely than females to choose a STEM major without regard to performance or life goals. Their decomposition analysis shows that at least since the 1980s, the gap in math performance explains less than one-third of the variation in field of study choices.

Mann and DiPrete (2013) suggested a more substantial focus on curriculum and the vertical and horizontal structure of education pathways to alternative elite careers. They emphasized the gendering of pathways from major to occupation. Their results also show that females are more likely than males to prefer a liberal arts education over selecting STEM-related majors. They also found that the law and medical fields have provided growing opportunities for women to construct separate pathways and pursue academic preferences. They suggested that future research can continue to look at these

differences and that the academic structure and professional organization need to be addressed in the roles they play in gender segregation in STEM fields.

Mann and DiPrete (2013) suggested some reasons females do not select STEM majors, including the perception that specific STEM fields do not foster positive work-family balance, and they perceived some STEM careers as having "chilly" climates towards women (p. 1532). They addressed the need for social policies to look at and address the female shortfall in the pursuit of STEM majors. Overall, this article was comprehensive and provided clear evidence of the issues they examined.

Related to the previous study, a qualitative study conducted by Rainey et al. (2018) examined racial and gender differences in how a sense of belonging influences students' decisions to major in STEM areas. They focused on students' sense of belonging in the STEM field and how that relates to their gender, race, and the intersections of those identities. This article also relates to the current study, focusing on female STEM majors. Their goal was to explore why there is a significant underrepresentation of women and students of color in STEM majors. The literature they reviewed addressed each of those dimensions individually and the intersection of both. Previous research showed that a sense of belonging in STEM significantly impacts academic success and perseverance, most significantly among females and students of color. Additionally, within STEM, both female and minority students consistently reported having less of a sense of belonging than male and White students (2018). The researchers found gaps in the literature focusing on women of colors' sense of belonging, which is why they explicitly discussed the intersections of race and gender in their analyses.

Rainey et al. (2018) incorporated Weidman's theory of undergraduate socialization to inform this study. This theory defined *interpersonal interaction* as one of the three processes of socialization, including relationships with peers or faculty. They examined interpersonal relationships and summarized that they feel socially linked or similar to peers in their STEM major if students form these relationships.

Participants of this study were purposively selected and included 201 seniors from diverse racial and gender backgrounds who were either majoring in STEM (labeled as *"majors")* or left STEM majors for others (labeled as *"leavers")* from 16 diverse colleges in North Carolina. Rainey et al. (2018) defined STEM majors as "engineering, physical sciences, earth, atmospheric or ocean sciences, mathematical and computer sciences, and biological and agricultural sciences" (p. 3). They restricted their sample to students who attended public school from kindergarten through grade twelve and were younger than 30 years old. Participants were contacted through email to set up interviews so they could choose to hold the interviews in person, over the phone, or virtually via Skype. Each interview lasted between 30 and 60 minutes and was recorded and transcribed. Each student received $25 for participation. The participants identified themselves as 66% female, 34% male, 48% White, and 52% students of color (31% Black, 8% Asian, 7% Hispanic, 2% Multiracial, 1% American Indian).

Rainey et al. (2018) used a partial grounded theory approach to their qualitative data analysis. Rainey et al. (2018) coded their findings as either student self-reports that he/she feels "belongs in STEM" or "does not belong in STEM" (p. 4). They used a mixed methods analysis to calculate z-scores that used a test of proportions to code their data.

Rainey et al.'s (2018) findings showed that female majors were significantly less likely than male majors to report that they felt they belonged in STEM ($z = 2.41$, $p < 0.001$). Both male and female leavers reported that they did not feel they belonged in the STEM field they left. They found that students of color majoring in STEM are significantly less likely to report a sense of belonging than White majors ($z = 2.23$, $p < 0.001$). They also found that women of color were the least likely to report a sense of belonging compared to all the other students ($z = 3.62$, $p < 0.001$). Codes uncovered from the interviews include interpersonal relationships, science identity, personal interest, and competence. They categorized responses based on reasons for belonging and reasons for not belonging. The researchers used the findings of this qualitative study as a part of a larger mixed methods study.

Rainey et al. (2018) found that a sense of belonging was reported more among males, White students, and STEM majors. They also found STEM students' sense of belonging correlated with the number of members of the students' gender who are also in their major. Implications of this study include demographic isolation associated with a lower sense of belonging; science identity contributes to a sense of belonging; interest in science plays a role in a sense of belonging; and interpersonal relationships are essential, both with faculty and peers. Their results highlighted that White males were most likely to report a strong sense of belonging, an overall issue that our society must address. Overall, the researchers conducted this study thoroughly and explained their rationale, processes, and findings. They provided very detailed and descriptive data throughout the article.

Related to the previous study, in their article, Tam et al. (2020) examined gender stereotyping and STEM education in Hong Kong. They highlighted the significance and need for strong STEM education to nurture and develop talents for these career paths. They found that there was limited research conducted in Hong Kong to look at the effectiveness of STEM education, so they conducted this study to address that gap. They aimed to address gender stereotyping, focusing on information communications technology (ICT) education. This article also relates to the current study as the researchers examined female STEM majors.

The purpose of Tam et al.'s study was "to supplement empirical results for the impact of STEM programs which are specifically designed" (p. 1) on female students on their personal development and gender stereotyping beliefs. They explored the impact of STEM education on alleviating gender stereotyping in ICT education.

Similar to the current study, Tam et al. (2020) explored students' self-efficacy in relation to ICT. They used self-efficacy as the research framework to test the effectiveness of STEM education in Hong Kong. They provided a clear explanation of self-efficacy and how it was related to their research.

Tam et al. (2020) did not include a substantial literature review in this article. They referred to previous research conducted in the United States and explained that this topic was not researched in Hong Kong but did not elaborate on those studies.

Tam et al. (2020) examined at a STEM educational extracurricular activity offered to 245 female students in Hong Kong enrolled in 7^{th} and 8^{th} grade in 13 secondary schools. Participation was voluntary, and the participants were not randomly selected but joined the study based on their interests. This program was purposefully designed with an

inquiry-based model to provide these students with ICT skills and knowledge and to develop them as critical problem solvers working on a specific STEM project with their innovation and creation. They followed ethical standards throughout this study.

Participants included female students aged 12-14 years old, enrolled in 7th or 8th grade. Tam et al. (2020) collected baseline data from these students before a workshop and post-training questionnaires after they completed the training sessions.

Tam et al. (2020) examined seven variables from the student participants. Those included problem-solving skills, analytical ability, ICT self-efficacy, perceived difficulties in using ICT, interest in studying ICT, perceived value of studying ICT, and gender stereotyping in ICT.

Tam et al.'s (2020) data analysis methods included Pearson's correlation test to measure the relationship between the variables. They found that all correlation coefficients between variables were above the significance level, demonstrating that all variables were closely related. They found that perceived difficulties in using ICT and ICT-related gender stereotypes were negatively correlated with other variables, suggesting that students with higher self-efficacy in ICT tended to have higher levels of other variables and were more likely to perceive ICT tasks as less difficult and less masculine. Next, they used regression analysis to test four of their hypotheses. Tam et al. (2020) found that students with higher problem-solving skills and analytical ability tend to have higher self-efficacy in ICT and lower perceived difficulties in using ICT; students with higher self-efficacy in ICT and lower perceived difficulties in using ICT are predicted to have a higher interest in studying ICT, leading to a higher perceived value of studying ICT; a high perceived value of studying ICT magnified the lowering effect of

self-efficacy in ICT on gender stereotyping; and the indirect effect of perceived difficulties in using ICT on ICT-related gender stereotyping was statistically significant. Tam et al. (2020) also conducted paired sample t-tests to compare the mean scores of each variable from pre-test to post-test. Their results showed problem-solving skills, analytical ability, self-efficacy in ICT, and interest in studying ICT significantly increased after attending the training sessions, and perceived difficulties in using ICT and ICT-related gender stereotyping significantly decreased. They demonstrated these results in tables.

The findings of Tam et al.'s (2020) study suggested "that an inquiry-based model should be adopted in more STEM education programs to promote students' problem-solving and analytical abilities" (p. 10), ultimately contributing to their ICT self-efficacy. They also discussed strong relationships among self-efficacy in ICT, perceived difficulties in using ICT, ICT-related gender stereotyping, and the perceived value of studying ICT. They highlighted the significance of perceived value in determining the perception of gender stereotyping among student participants. This study "provides empirical evidence on the effectiveness of a STEM education program in enhancing student development and gender equality in ICT" (Tam et al., 2020, p. 10). They showed that STEM education can effectively empower girls, which can contribute to equality in the ICT industry, relating to the current study. Overall, the researchers thoroughly explained their results in tables that clearly demonstrated what they were examining.

Davison et al. (2014) conducted a quantitative analysis to look at patterns of SAT scores, choice of STEM major, and gender. This article relates to the current study examining female students selecting STEM majors. Career theory guided their study.

Davison et al. (2014) also suggested utilizing Hackett's social-cognitive career theory to examine academic preparation and self-efficacy, similar to the current study. Also similar to the current study, Davison et al. (2014) looked at students' self-efficacy, specifically how academic preparation impacts how students feel about their abilities.

Their review of the literature demonstrated that for the prior 50 years, studies that investigated relationships between academic preparation and choice of college major focused on the choice of a major in science, math, technology, or engineering. They described academic preparation consisting of test scores, high school grades, and courses taken in high school.

Davison et al. (2014) aimed to examine whether verbal abilities are critical to choosing a STEM major, which previous studies did not include. They suggested that if a student perceives their quantitative abilities as higher than their verbal abilities, the student will tend to expect more success in STEM areas than in non-STEM areas, which will lead them toward selecting a career in the STEM field. They also suggested that if a student perceives their verbal abilities as higher than their quantitative abilities, then those students will tend to expect more success in non-STEM areas than in STEM areas, and this can lead them toward selecting a non-STEM career.

Participants of this study included 7,610 graduates selected from a pool of 10,030 students who graduated from college in 1999 and 2000 and were in the Baccalaureate and Beyond Longitudinal Study, which the National Center on Education Statistics sponsored. The ethnicities of the participants were: 74.4% White, 7.5% Black, 8.8% Hispanic, 6.6% Asian, 0.6% American Indian/Native Alaskan, 0.6% Hawaiian/Pacific Islanders, and 1.5% other. Participants' ages ranged from 18 to 74, with a mean age of

25.48, a median of 23, and a standard deviation of 7.104. The participants were 55.5% female and 44.5% male.

The researchers used the SAT Verbal (SATV) and SAT Quantitative (SATQ) as verbal and quantitative reasoning assessments. Davison et al. (2014) grouped college majors into nine categories: humanities, social behavioral sciences, life sciences, math/physical sciences, computer/information sciences, engineering, education, and business. This study employed a cluster sampling design. Davison et al. "employed the strata and primary sampling unit information provided by the data with the AM Software to correctly estimate the standard errors" (p. 121).

Their results indicate that 40.2% of females had higher SATQ than SATV scores, and 55.8% of males displayed that pattern of scores. The SATV regression weight was negative and significant ($p < 0.05$) for all STEM majors, suggesting that those with higher SATV scores were less likely to choose a STEM major over the humanities, also verbal ability is negatively associated. For the STEM majors, 50.6% of students had higher SATQ scores than SATV scores for the life sciences. These findings can address why students with equal math and science abilities may not be equally interested in STEM careers. Females that have high quantitative abilities may also have very high verbal abilities. School counselors working with students of varied abilities need to look beyond math and science abilities. They suggest successful STEM students also have strong verbal skills, communicate effectively, and work well with others.

This article included several tables of data that were clearly organized and allowed data and results to be easily understood. The researchers' suggestions for school counselors working with talented high school students are valuable and practical. Their

discussion section connects to the current study in that school counselors should discuss more than math and science abilities as factors to consider when advising students on STEM interests. Other literature related to the current study addressed pursuing STEM careers once students attain STEM education. These articles also include gender discrepancies.

STEM Careers

Previous studies relating to the subsection of STEM careers include topics such as science education and gender issues, access to counseling and STEM careers, and influences on career advising. Related to the current study, in their article on students deciding to pursue STEM studies, Murcia et al. (2020) conducted a study in Australia to look at influences on these decisions. This qualitative study used the social cognitive career theory as the framework to investigate the influences of career choices, similar to the current study, which utilized a similar theoretical framework. Murcia et al. (2020) aimed to address the demand for STEM professionals exceeding the supply of qualified, trained graduates. The researchers investigated the factors that influence children in their future career choices. They interviewed 15 lower secondary school students, 15 of their parents, and three career counselors from three schools in Western Australia. The purpose of this qualitative study was to discuss the impact of learning environments on students' STEM career interest and self-efficacy; explore the impact of parents' attitudes on STEM engagement and determine how career counselors' awareness and engagement with STEM majors can impact students' career interests. This article relates to the current study in that the researcher examined STEM studies.

In their literature review, Murcia et al. (2020), based in Australia, explored research conducted worldwide. Specifically, they examined research conducted in the

Netherlands, England, the U.S., Canada, India, and other parts of Australia. They specifically addressed the gap between the increase in demand for STEM professionals and the supply of graduates. The researchers suggested that STEM opportunities should be provided to all children, beginning at young ages in school.

The theoretical framework employed in this study was self-efficacy, stemming from the social cognitive career theory (SCCT) (Lent et al., 1994), which utilized a theoretical framework similar to that of the current study. The authors described SCCT in detail and related it to their work. The researchers focused this study on middle school students, as their research found that it is a critical time for exploration and acquiring academic and career-related interests, in combination with attitudes and beliefs relating to competence in different areas.

Murcia et al. (2020) discussed specific aspects of career planning that school counselors perform, including course selection, promotion of academic rigor, strategic direction, and attention to under-represented groups. They suggest that school counselors need to increase their awareness of modern career opportunities, specifically related to STEM fields. Moreover, Murcia et al. (2020) emphasized the need for increased professional development.

The method employed by this study was qualitative and aimed to investigate the factors that influence childrens' ideas and choices about STEM careers. They specifically invited three secondary schools to participate in this study since their career counselors were active and highly regarded in their professional associations. They conducted semi-structured interviews and a focus group with five 10-year-old students, followed by a focus group of their parents. Murcia et al. (2020) obtained written consent, recorded each

meeting, and later transcribed the interviews. Their initial analysis used open coding followed by axial coding. Murcia et al. (2020) repeated data sorting to ensure triangulation. The themes that emerged included influencing STEM career choices, accessing STEM resources and support, valuing STEM careers, and envisioning future STEM careers. They analyzed and explained research findings for the students, counselors, and parents separately in an easily understood manner.

Murcia et al.'s (2020) findings demonstrated that students appreciated their interactions with career counselors and teachers and their hands-on experiences in STEM learning. They found strong links between parents' STEM careers and students' interests in similar fields. All counselors also saw the connection between parental influence and their children's interests. The counselors aimed to support students in all interests and wanted to learn more about specific STEM changes and opportunities for their students.

Murcia et al. (2020) described informed and meaningful discussions among each group during the interviews. They address the significance and importance of career counselors' roles in advising students at young ages, coupled with parental involvement and support in exploring STEM and other areas.

In another article related to STEM career selection, Mau and Li (2018) explored factors that influence the STEM career aspirations of high school students. They looked at previous studies and included minorities and females and the factors influencing STEM career aspirations from a longitudinal perspective.

Participants of Mau and Li's (2018) study include 21,444 ninth-grade students from the High School Longitudinal Study of 2009-2014, conducted by the National Center for Education Statistics (NCES, 2015; Ingels et al., 2014). The four factors they

examined include gender and race, familial/parental, school/academic, and personal/psychological. The researchers examined whether differences exist among the four factors as a function of STEM career aspirations and how those factors impact students pursuing STEM careers. This sample comprised ninth graders from 944 public and private high schools across the United States. The make-up of students included 50.9% males and 49.1% females; 55.3% White, 15.4% Hispanic, 10.4% Black, 8% Asian, and 10.9% Other. These students' parents, principals, math and science teachers, and each high school's lead counselor completed surveys by phone and online.

The dependent variable was STEM aspiration, which they measured by asking, "Which occupation do you expect or plan to have when you are 30 years old?" Mau and Li (2018) coded these responses as STEM or non-STEM. STEM-coded responses included computer and mathematical occupations, architecture and engineering occupations, and life, physical, and social science occupations. Independent variables included the four clusters of gender and race, familial/parental, school/academic, and personal/psychological. Mau and Li's (2018) found that each of these clusters significantly predicted the occupational aspirations of female and minority students.

Mau and Li (2018) conducted bivariate analyses to compare various characteristics of students' STEM aspirations. They conducted three MANOVAs to compare differences in STEM aspirations by three clusters of variables, including familial/parental, school/academic, and personal/psychological. Then, they conducted ANOVAs on these variables. Following this step, they conducted logistic regression analyses to examine these factors that predicted STEM aspirations.

Mau and Li's (2018) results were explained clearly and accompanied by tables that were easy to read and understand. Of the 21,444 students, 2,416 aspired for STEM careers, with 19,028 interested in non-STEM careers. The data collected indicated students' chose computer and mathematical occupations (n = 324), architecture and engineering occupations (n = 986), and life, physical and social science occupations (n = 1,106). Results from the MANOVA showed significant differences in familial/parental variables - Wilks's $\Lambda = .97$, $F(4, 9907) = 66.63$, p = .000, $\eta p2 = .03$; school/academic variables - Wilks's $\Lambda = .95$, $F(8, 18252) = 131.13$, $p = .000$, $\eta p2 = .05$; and personal/psychological variables - Wilks's $\Lambda = .92$, $F(8, 13888) = 147.66$, $p = .000$, $\eta p2 = .08$. They also conducted logistic regression analyses to examine variables that predict STEM aspirations. The percentages of variance in STEM aspirations accounted for by the models were 40% (Model 1), 53% (Model 2), 55% (Model 3), and 56% (Model 4). They explained their results with clear descriptions.

Using the CAM as their conceptual framework, Mau and Li (2018) found the following factors significantly influence STEM aspirations: being male or White, having a higher SES, having greater parental educational expectations, having greater math achievement, and the most significantly, having higher math interest and math/science self-efficacy.

Mau and Li (2018) addressed the limitations of their study, noting that they relied on students to self-report their responses, which can be susceptible to errors. They also asked these adolescents about their career goals for when they are 30 years old, which can change frequently.

This article has several similarities to the current study. First, it focuses on high school students, specifically females, and their interest in STEM careers. Second, Mau and Li (2018) found that high school is when high school counselors can implement interventions to assist students with their career aspirations. The researchers suggested that these results can assist school counselors and administrators identify students who show interest in STEM careers and provide appropriate support to reach their goals. They recommended that high school counselors should collaborate with others to decrease barriers to students' academic success by promoting academic achievement, self-efficacy and identity, and self-advocacy for female and minority students. Additionally, Mau and Li (2018) looked at social cognitive career theory (Lent et al., 1994), similar to the current study.

Reinking and Martin (2018) conducted a study on STEM career selection. In this article, the researchers employed a qualitative methodology of summative content analysis of previously conducted research studies. They investigated the increase in females studying STEM majors yet not pursuing careers in STEM areas.

The researchers examined why female representation is lower in STEM career areas and how educators can increase girls' curiosity in STEM. This study relates to the current study as they both examined the gender gap in STEM. The current study focused specifically on the role high school counselors can play in decreasing this gap. Conversely, this article focused generally on teachers and strategies they can employ to encourage their female students to engage in STEM.

Reinking and Martin's (2018) study aimed to investigate and summarize previous research focused on girls and STEM. They researched theories and phenomena to explain

the gender gap in STEM fields, strategies, and ideas for females to engage in STEM opportunities, and the role educators can play in closing the gender gap in STEM areas. Reinking and Martin (2018) reviewed previous articles, specifically looking for the following terms: *STEM, Gender Gap, Girls, Education,* and *Teaching*. They read, summarized, and coded articles from 2005-2017. They coded for themes to understand, examine, and provide guidance on closing the gender gap in the field of STEM.

Reinking and Martin (2018) described three main findings that encourage females to become interested in STEM areas. Their first finding was that the gender gap can relate to three theories. Those theories include gendered socialization, peer groups, and stereotypes of STEM professionals. The second finding addressed engaging girls in STEM fields, specifically focusing on STEM movements and educational strategies. Their third finding addressed teachers' next steps, including providing experiences and role models, facilitating positivity and curiosity, and peer STEM learning environments.

Overall, Reinking and Martin (2018) did a thorough job conducting this study and explained it clearly and concisely. They noted that it is critical to continue encouraging all students to pursue STEM interests, as they stated,

> It is important to remember that if the pendulum swings too much the other way, boys will be marginalized in STEM fields…It should be the goal of advocates and educators to close the gender gap and not create a gender gap in the opposite direction (Reinking & Martin, 2018, p. 152).

This aspect was significant to note, as the researchers did not want their study to

result in a different gender gap. In their results section, the researchers emphasized understanding the critical roles teachers play in the lives of children, demonstrating the influence educators have on their students to have a life-long impact on their futures.

The results of this study relate closely to the current study in that their study also examined previous research that shows a gender gap in both STEM studies and careers. The researchers found that hands-on learning can play a role in students' interests, a topic explored in the current study.

In another article on STEM careers, Mohtar et al. (2019) conducted a study in Malaysia. This quantitative study addressed the lack of participation in STEM careers globally, specifically focusing on this issue in Malaysia. Their literature review focused on factors that influence interest in STEM careers.

Mohtar et al. (2019) conducted a very thorough literature review, including significant information in their article. They addressed the dichotomy between the larger number of female students on college campuses. However, there was a lower number of females earning bachelor's degrees in STEM majors. They found no research in over 20 years that looked at high school counselors as potential explanations for why more women graduate from college than men, but fewer go into STEM fields. The researchers pointed out that students look to their school counselors for academic, career and college advice and support and that counselors play critical roles in helping students. Mohtar et al. (2019) did not point to any specific theories in this article, which is a weakness of this study.

Mohtar et al. (2019) investigated environmental factors, including learning experiences, social influences, and media, and how those impact career choices. The

purpose of this study was to develop a model on interest in STEM careers based on survey data that focused on environmental factors, self-efficacy, and perceptions of STEM careers. The method employed in this study was surveys, using a questionnaire as their instrument. They used cluster sampling among students across four states in Malaysia. Participants included 300 students per state, totaling 1,800 students that were all 14 years old. The study included 1,485 surveys after removing extreme outliers and missing data. The instrument used was a survey, including 63 items that measured five constructs, including interest in physical sciences STEM careers, interest in life sciences STEM careers, perceptions of STEM careers, self-efficacy, and environmental factors.

Mohtar et al.'s (2019) results demonstrate that the structural model fits the data well. The normed Chi-square $\chi 2$ was 3.847, demonstrating compatibility that their hypothesis model fits with the survey data; $\chi 2$ was greater than one and less than five. The Root Mean Square Error of Approximation was .044, less than .08, showing that the model was considered a good fit. The Comparative Fit Index was .912. The Tucker-Lewis Index was .908. The Incremental Fit Index was .912. Each value is larger than the suggested value of .90, demonstrating that the structural model fits the data well.

Mohtar et al. (2019) highlighted that their most significant result was that female counselors were 13.6 percentage points less likely to recommend math to a female student than English. They also found that counselors showed a bias against male students regarding their success at a selective institution. They generally ranked outstanding male students approximately 0.35 points lower than outstanding female students, or a 10-point scale. These findings demonstrate that high school counselors contribute to the STEM gender gap. They found no evidence that male counselors rated

students differently based on gender. They attempt to explain this divide by looking at the advice students receive during high school. They examined if preconceived cultural biases held by high school counselors may impact the recommendations they give their students and if they differ across genders. The participants that responded to the survey were more likely to be female, have lower salaries, work at schools with higher rates of minority and financially disadvantaged students, and work in schools with higher test scores and lower student-to-teacher ratios. They clearly explained their analysis, results, and findings throughout the article and in tables.

This study explained that interest in STEM careers that develop shows that environmental factors influence STEM self-efficacy and perceptions of STEM careers, which can influence interest in STEM careers. Similar to the current study, these researchers suggest that educators play significant roles in supporting their students and their interest in STEM careers. They also suggest that the media plays a role in students' perceptions of STEM and should collaborate with others to meet students' needs.

School Counselor Impact on STEM Majors and Careers

Articles relating to the subsection of school counselor impact on STEM majors and careers include the impact of school counselors, school counselor role in college advisement, school counselor role in career planning, and school counselor training.

Addressing the roles of school counselors in college advisement, Welsch and Winden (2019) investigated the impact of student and counselor gender on college advice given to students. They specifically looked at the advice high school counselors give their students and whether the counselors' gender can explain the gender disparity between the number of females on college campuses and the smaller number of females pursuing

STEM majors. Relating to the current study, this article looked at high school counselors providing career advisement.

This article refers to the development of the *pipeline model* (Berryman, 1983) to understand the attrition of students who study STEM to those who pursue STEM careers. The pipeline is a metaphor to describe how women become underrepresented minorities in the STEM fields (Sheltzer, 2014).

This study consisted of sending surveys to high school counselors in Wisconsin. The researcher sent 495 emails from female students, and 482 received emails from male students. They aimed to assess how successful a student would be at a more selective college and which major, math or English, counselors would recommend to each student. They wanted to see if the counselor's gender affected their recommendations to male and female students. The researchers sent the surveys randomly.

Welsch and Winden (2019) suggested that this information can have long-lasting effects on students' college decision-making. They recommended creating policies to reduce both conscious and unconscious biases in the high school environment to impact the STEM gender gap. They recommended training programs and workshops specifically targeting high school counselors, teachers, and administrators to examine these biases, relating to the current study. Their finding that school counselors' beliefs and biases influence the STEM gender gap supports policies and interventions.

Martinez et al. (2021) examined the School Counselor STEM Advocacy Survey (SC-STEM-AS) in their quantitative study to determine its factor structure in school counselors' impact on students interested in STEM. The researchers noted that those employed in science and engineering careers tend to have higher wages and lower

unemployment rates than others. However, most students who graduate college with a STEM degree, will end up in a non-STEM job. They suggested that school counselors advocate for increased student participation in STEM activities to decrease that difference. This article is related to the current study in many aspects. This article looked at high school counselors working with students interested in STEM. Additionally, the participant qualifications and rationale for the sample are congruent to the current study.

Martinez et al. (2021) stated that data-based research is needed to demonstrate how school counselors' advocacy is conceptualized in the profession, which is why they conducted this study. They explored general advocacy instruments for use with school counselors. They did not find any that help school counselors assess whether they advocate for equity and access to students' coursework and postsecondary opportunities in STEM and other careers. However, they did not look at any other types of previous research or literature. They suggested that an ideal instrument would identify STEM advocacy dimensions that enhance comprehensive school counseling programs, help in future studies to test those dimensions and related measures and outcomes and help determine how school counselor STEM advocacy differs and aligns with other advocacy frameworks. They conducted this study to meet the need for that instrument.

The purposes of this study were to discuss the development of a School Counselor STEM Advocacy Survey (SC-STEM-AS) measure and to determine whether the previously found two-structure of the SC-STEM-AS from their exploratory factor analysis (EFA) fit the data for a large sample using confirmatory factor analysis (CFA), to examine convergent and divergent validity of the SC-STEM-AS with a measure on the School Counselor Self-Efficacy Scale (SCSE), and to examine demographic differences

on the SC-STEM-AS. They included school counselors' characteristics, employment context, and school counselor perceptions as demographic variables, all similar to the current study. They looked at counselor self-efficacy in this study, relating to the theoretical framework of the current study, which looks at students' self-efficacy. They provided an in-depth description of the development and initial validation of the SC-STEM-AS instrument, where they addressed previous literature and research.

Martinez et al.'s (2021) methods and data collection sections were very descriptive and easily understood. They had 917 participants, 721 of whom were female and 196 were male. Their ages ranged from 25 to over 60. They worked throughout the entire United States. They provided tables with demographic data and clear and easy-to-understand results. To recruit participants, they sent surveys electronically to 6,000 members of ASCA. They obtained approval from the university IRB and followed all ethical guidelines throughout this study.

Martinez et al. (2021) conducted a CFA on the SC-STEM-AS items using Mplus 8 to measure a two-factor measurement model identified a priori based on theory and previously conducted research. They examined skewness, kurtosis statistics, and critical ratios. They used Bollen-Stine bootstrap *p*-values with the usual maximum-likelihood-based chi-square and *p*-value to measure overall model fit. Other model fit indexes they used included the relative or normed chi-square, the comparative fit index (CFI), the non-normed fit index (NNFI), and the root mean square error of approximation (FMSEA). Martinez et al. (2021) conducted model modifications using the modification indexes and standardized residuals as guidelines to develop a better fitting and more parsimonious

mode. They looked at correlations between the factor scales on the SC-STEM-AS and SCSE to assess evidence of convergent validity using Pearson correlation analysis.

Martinez et al.'s (2021) results showed that most of the skewness and kurtosis critical ratios were greater than 2.0, indicating the multivariate normality of the data. Regarding their initial model, they overidentified with 91 parameters and 134 degrees of freedom. One factor was scaled to a parameter of 1.0. The model included Promoting STEM Access and Promoting STEM Equity; all loadings were significant at the $p < .001$ level. Regarding the modified model, they made modifications to the model in order to determine whether a stronger model fit could be attained. They correlated the five pairs of error terms, resulting in an improved and moderate fit. Regarding convergent and divergent validity, they looked at the correlations between the two subscales on the SC-STEM-AS and SCSE Scale. The correlation between those scales was .42, which was significant at the .001 level.

The average SC-STEM-AS composite scale for the sample ($N = 597$) was 2.68 ($SD = .75$) on a scale of one (low) to five (high). Martinez et al. (2021) found that 10 of the 14 demographic categories were significant. Those included school counselor characteristics (ethnicity, years of experience, extent of STEM advocacy training), employment context (school size, school level, caseload, free and reduced lunch, school diversity), school counselor perception (perceived challenges for not having enough time to advocate for STEM, perceived challenges for more staff buy-in for advocating for STEM).

The researchers found group differences within this sample among school counselor characteristics, employment context, and school counselor perceptions. The

current study also looked at similar characteristics, including school counselor characteristics and employment context. This study looked at elementary through high school counselors, whereas the current study only looked at high school counselors' perspectives.

Martinez et al. (2021) addressed limitations, including response bias and social desirability as potential biases, similar to the current study. These findings may not be generalizable to all school counselors. They did show that the SC-STEM-AS may be an effective measure for identifying school counselors' practices. Overall, the researchers conducted a thorough study and clearly explained their results and potential uses to utilize this scale.

Nikischer et al. (2016) explored how high school counselors can impact students' postsecondary majors and programs after high school. They specifically looked at counseling departments in two different school environments to see how they can impact students' STEM participation in high school and potentially impact college and career STEM choices. Nikischer et al. (2016) addressed the weak pipeline between college and career choices in the STEM fields. They addressed the need to explain the significance of the roles school counselors play in improving math and science outcomes and increasing pathways to STEM fields. Relating to the current study, this article examined high school counselors providing college and career advisement to their students.

Nikischer et al. (2016) conducted a thorough literature review, including looking into educational policies created to address the gap in underrepresented populations pursuing STEM. Their research included the importance of highly trained school counselors, committed math and science teachers, competitions including science fairs,

science bowls, robotics challenges, and summer enrichment programs. They also addressed the importance of extracurricular activities, including afterschool programs and clubs, specifically to engage female students in these topics. Nikischer et al.'s (2016) research included the developmental stages of adolescents. They addressed the high school years specifically as a critical time for career exploration and decision-making, which emphasizes the importance of highly trained school counselors and their career counseling expertise. They also addressed the rapidly changing STEM fields and the need for updated professional development opportunities for school counselors to continue to learn throughout their careers to assist students in STEM areas.

The purpose of this article was to look at the extent to which the work of two counseling departments shapes students' STEM participation in high school and the specific ways the departments differ in serving students of different races, ethnicities, and socioeconomic statuses. The researchers collected data from two different high schools over one year. One school is a large urban high school made up of primarily low-income, underrepresented minority students, and the other is a large comprehensive public school made up of mostly middle/upper-middle-class White students.

The researchers collected data from school and district documents, including course offerings, sequences, prerequisites, strands, tracks, and counseling materials. They interviewed eight 11th-grade students in each school, four parents from one school and six parents from the other school, five math and science teachers from each school, three counselors from one school, and one counselor from the other school. Interviews focused on views of the school, students, STEM opportunities and experiences, college preparation, and postsecondary plans, including college and career choices. Each

participant was purposively selected to participate in this study. They also conducted 36 school and classroom observations. They recorded and transcribed all interviews and coded for themes, including STEM-related opportunities, meanings of school and STEM, sources of support and assistance, and future plans.

Nikischer et al.'s (2016) results show stark differences between the two schools, including students' high school STEM participation and the roles of school counselors in supporting students in college and career advising. They provided extremely thorough descriptions of the observations they conducted. Nikischer et al. (2016) provided clear descriptions of student, teacher, parent, and counselor responses to the interview questions. They found that the suburban school provides students with substantially more college counseling services, specifically related to STEM fields. Nikischer et al. (2016) found gaping holes exist in college counseling opportunities in urban high schools. They showed that students and their families are at an economic disadvantage in pursuing opportunities for postsecondary education.

Nikischer et al. (2016) suggested that counselors need to engage in ongoing training in college and career counseling, specifically related to STEM opportunities. They recommended that schools offer high-level math and science courses and encourage students to enroll in the highest-level courses they can successfully complete. Furthermore, they advised that school streamline course selection processes and encourage high-level students to enroll in the most rigorous courses offered.

Sherman-Morris et al. (2019) explored school counselors' perceptions regarding geosciences (geology, meteorology, and geoscience) and the career exploration resources they use to help their students. They were looking for differences in counselors'

perceptions about geoscience majors and other STEM (biology and engineering in this article) fields. Sherman-Morris et al. (2019) conducted an exploratory study to determine what school counselors know and believe about geosciences and to explore which activities they use in career counseling. They focused on underrepresented students, specifically those first-generation college-bound students. Sherman-Morris et al. (2019) addressed the importance of students' socioeconomic status as a factor influencing college majors and career choices. The researchers addressed the importance of exposing students to these geosciences at younger ages to get them excited and interested in learning about these areas in college. Relating to the current study, this article looked at high school counselors and STEM areas.

Sherman-Morris et al.'s (2019) literature review was very comprehensive and showed previous studies that found significant differences in these areas. They pointed out the importance of resources to help students in their career exploration. Sherman-Morris et al. (2019) focused on school counselors' ability to influence students' college and career planning, and parental support and involvement. They addressed the importance of school counselors working with underrepresented students in their college searches. Sherman-Morris et al. (2019) explained the importance of starting career exploration earlier, but that high school is not too late to plan for students' futures. They did not include a theoretical framework in their article. They did not reference any theories in their literature review or when discussing their study.

Sherman-Morris et al. (2019) created a questionnaire to survey school counselors on their career counseling activities and their awareness of geoscience (specifically geology and meteorology) fields and careers. Questionnaires were distributed online and

in person at a large conference for school counselors in Mississippi. Questions included career counseling topics, school district specifics, and STEM majors and careers. The sample consisted of 43 school counselors who responded to the surveys.

The average caseload for participants was 386 and ranged from 130 to 968 students. Of the participants' school districts, 88% were rural, and 65.4% of students were considered college-bound. Their results point to greater effort needed to increase awareness of geosciences, specifically at the high school level. They also conveyed the importance of parental involvement and teachers as influential individuals in students' career exploration processes. Many of the responses were similar to the entire state of Mississippi, which is useful for generalizing the results. Thirty-five participants responded that the majority of their students use career interest inventories for career planning. Their responses demonstrate that students of lower socioeconomic status have fewer resources, including limited campus visits and access to admissions officers.

Approximately 50% of participants said they provide additional counseling activities when advising their first-generation college-bound students. Sherman-Morris et al.'s (2019) literature review supports this finding. In their final results, they discussed the different perceptions of geoscience majors, similar to the results they found in previous studies. They found that this lack of knowledge impacts perceptions of job potential, which decreases student and parental interest in that field. Overall, these school counselors showed a lack of knowledge in geosciences, and they suggested that they should be exposed to these fields to share this knowledge with their students.

Sherman-Morris et al. (2019) addressed the limitations of this study, including the small sample size. They did not ask participants to share their personal demographic

information, which did not allow the researchers to understand if the sample represents the population of school counselors in Mississippi. They recommended that future research should provide significant professional development to school counselors on specific career opportunities, specifically adding geosciences. They should also spend time addressing students from underrepresented populations and matching career opportunities.

In a related article, Brookover (2021) conducted a multivariate, quantitative, longitudinal research study to investigate the long-term impacts of access to school counselors, specifically relating to student characteristics, on STEM outcomes. Brookover (2021) based this study on previous school counseling, STEM attainment, and persistence studies. Similar to the current study, this article investigated high school counselors and STEM studies. Brookover (2021) suggested that school counselors play integral roles in helping their students prepare for college by providing college-readiness counseling, and this study focused on STEM possibilities. The researcher shared an issue in STEM education attainment and persistence.

The literature review highlights the demand for STEM workers in the United States based on a lack of qualified and interested people to pursue those fields. Brookover (2021) cited disparities in STEM college major attainment and persistence among gender, race, ethnicity, socioeconomic status, and first-generation college student status. Brookover (2021) shared ASCA guidelines for school counselors to "ensure equitable postsecondary opportunities and outcomes for all students" (p. 384). Brookover (2021) explained the importance of high school counselors providing developmentally appropriate career-readiness counseling to their students, which should include creating

postsecondary goals and expectations, building an awareness of students' interests and abilities, and providing information and support for college access and success. Each of these tasks can have a STEM focus for those students interested in those fields. Brookover (2021) shared information regarding research that is developing on school counselors' roles in students' STEM self-efficacy and pursuit of postsecondary STEM education. She looked at previous studies that help school counselors support STEM for all students, especially those from underrepresented groups.

Brookover (2021) utilized social cognitive career theory (SCCT) as the theoretical framework to guide this study (Lent et al., 1994), which utilized a similar theoretical framework to the current study. This theory unifies career and academic interest, choice, and performance. Brookover (2021) shared that self-efficacy can be described as people's beliefs about their abilities to perform specific tasks. Brookover (2021) provided an example as students believe they can achieve their science goals through their abilities and actions, referred to as high science self-efficacy. Brookover (2021) suggested that SCCT can account for external factors, in this study, school counseling access, individual differences, demographics, and self-efficacy within long-term career development formation.

The purpose of this study was to investigate the long-term impacts of school counseling access, specifically relating to student characteristics, on STEM outcomes. Brookover (2021) wanted to see if counselor caseload and percentage of time spent on college-readiness counseling could predict STEM major attainment and persistence. Brookover (2021) used a multivariate, quantitative, longitudinal research design in this study to gather and analyze data on development over time. She employed a method of

secondary analysis to existing data from the High School Longitudinal Study of 2009. This study included 23,000 ninth-grade students from 944 high schools. This sample was random and stratified to represent a nationally representative sample. Approximately 900 high school counselors were surveyed and provided information on their departments, caseload, and percentage of time spent on college-readiness counseling. Baseline data was collected in 2009 and followed up in 2012, 2013, and 2016.

Demographic variables included first-generation college student status, race/ethnicity, sex, and socioeconomic status. Self-efficacy variables included math self-efficacy (continuous variable, was standardized to a mean of 0 and standard deviation of 1, coefficient of reliability for the scale is 0.65) and science self-efficacy (continuous variable, mean of 0, standard deviation of 1, coefficient of reliability for the scale is 0.65). Brookover (2021) included STEM GPA as an interval variable, ranging from 0.25 to 4.0. Brookover (2021) assessed school counselors' caseloads through the questionnaire, which ranged from 2 to 999. Brookover (2021) recoded this variable into a dichotomous variable: 0 indicated 250 or fewer students, and 1 indicated 251 or more students on caseload. Counselors also reported spending 21% or more time spent on college-readiness counseling. A dichotomous variable, Not STEM or STEM was collected to identify students who chose to pursue a STEM degree or college or not.

To analyze data, Brookover (2021) followed steps for secondary analysis of existing data. Brookover's (2021) first step was to run preliminary analyses of descriptive statistics and bivariate correlations and then assess missing data patterns. Value imputation occurred where there were missing responses for select variables identified through the student and parent questionnaires through single-value imputation.

Brookover (2021) completed assumption tests and ran sequential logistic regression to use the criterion measures on a binary outcome.

Brookover (2021) created tables that were very easy to read and understand. She ran and explained descriptive analysis and a correlation matrix. The sample identified 50.9% of the sample as female and 49% as male. The study consisted of 22,497 participants in total. Math self-efficacy scores ranged from -2.92 to 1.62 (M = 0.0421, SD = 0.96). Science self-efficacy scores ranged from -2.91 to 1.83 (M = .0372, SD = 0.99). School counselor caseloads had a mean score of 347.65 students (SD = 130), and the median was 350. School counselors' percentage of time they spent on college-readiness scores ranged from 1-5 (M = 3.37, SD = 0.95). 23% (n = 2,658) of the valid sample demonstrated STEM major persistence and attainment variables, and 77% (n = 2,132) did not demonstrate that.

Brookover (2021) conducted a bivariate correlational analysis of interval and ratio variables to allow for a preliminary examination of collinearity and provide information on relationships between specific variables. These correlations show indications of relationships to school counseling access. She found a correlation between SES, STEM GPA, and math self-efficacy that negatively impacts school counselors' caseloads significantly. The percentage of time school counselors spent on college-readiness counseling positively correlated with SES, STEM GPA, math self-efficacy, and science self-efficacy. Then, sequential logistic regressions were run. Model 1 was significant, $F(9, 189) = 12.49$, $p < .001$. McFadden's R Square was 0.0506, which indicated that the model explains 5.06% of the variance outcomes. This result indicates that SES significantly predicted STEM major attainment and persistence ($\beta = -0.94$, $p < .001$).

In this study, Asian students were significantly more likely than White students to report their STEM major attainment and persistence (β = -0.91, $p < .001$). Model 2 was significant, $F(12,185) = 19.03$, $p < .001$, McFadden's R Square = 0.0966. Results show that students' STEM GPA significantly predicted their STEM major attainment and persistence. Students with GPAs ranging from 0.25 to 2.75 were significantly less likely to report STEM attainment and persistence than those with GPAs of 3.00 to 4.00(β = -0.64, $p < .001$). Both math self-efficacy (β = 0.27, $p < .001$) and science self-efficacy (β = 0.26, $p < .001$) were found to be significant predictors of STEM major attainment and persistence. Female sex and Asian race identity were both significant; SES was not significant.

Model 3 was significant, $F(14,178)$, = 15.90, $p < .001$, McFadden's R Square = 0.1005. School counselors' percentage of time spent on college-readiness counseling predicted student STEM major attainment and persistence, with 21% or more time spent on college-readiness counseling is more likely to result in the outcome, as compared to 20% of less time spent on college-readiness counseling (β = .26, $p < .05$). Counselors' caseload was not significant. Female sex, Asian race identity, STEM GPA, math self-efficacy, and science self-efficacy were all significant predictors in the model.

This article showed that school counselor caseload was insignificant, which differs from previous literature and research. Brookover (2021) found that smaller caseload benefit students, and ASCA recommends a school counselor ratio of 250 students to 1 school counselor (ASCA, 2022; Brookover, 2021). This article relates to the current study in that the current study also examined counselor caseloads and time spent on specific counseling tasks, including college-readiness counseling. This article also

connects to the current study in that counselors shared the amount of time they spend on each of their tasks.

Conclusion

There is substantial research on the critical timing of adolescence, STEM majors, STEM careers, and school counselors' impact on STEM majors and careers. These studies each present salient points that connect directly with the current study. The critical timing of adolescence addresses why the researcher selected high school counselors who work directly with adolescent students as the participants for this study. The researcher included studies that examined STEM majors due to the significant planning and programming done to assist students in matching their talents and interests to their academic talents and goals, another focus of the current study. The articles included in STEM careers point to the presence of gender differences, the issue at hand in the current study. The research included the literature relating to school counselors' impact on STEM majors and careers due to their roles as student advocates, specifically for college and career planning, as is a focus of the current study.

Each article relates to the current study, whether focusing on school counselors, STEM majors, or STEM careers. Each article has findings connecting the current existing literature to the present study. The current study aimed to synthesize themes from the present literature while offering suggestions to school counselors for continuing to decrease the gender gap among female students in STEM majors and careers.

CHAPTER 3

Introduction

This chapter includes the research design, research questions, detailed explanations of methods and procedures, including setting, participants, data collection procedures, data analysis approach, trustworthiness of the design, research ethics, and researcher's role.

Research Design

A qualitative research design was selected for this study to understand how high school counselors influence female students' choices of STEM majors. The researcher employed a multi-case for this study to obtain an in-depth exploration of multiple perspectives (Creswell & Poth, 2016). Multi-case studies include two or more cases to investigate the same phenomena (Lewis-Beck et al., 2003). Qualitative case studies examine the experiences of real-life cases operating in real-life situations (Stake, 1995). Qualitative research tells a story to provide an understanding of a situation (Yang & Cornelius, 2004).

In this multi-case study, the researcher investigated and explored seven real-life cases through detailed, in-depth multiple sources of data collection, resulting in descriptions and themes. The researcher analyzed and drew conclusions from those themes (Creswell & Poth, 2016). According to Stake (1995), in multi-case studies, the cases need to be similar, and in this study, each case is a current high school counselor working with female students. Collecting and analyzing qualitative data was necessary to explore this topic. This study aimed to compare and replicate its findings. Multi-case studies produce more compelling evidence and are considered more robust than a single-

case study (Yin, 2017). The researcher reported responses from individual cases, drew cross-case conclusions, and formed a cross-case report (Yin, 2017). The researcher examined multiple cases to understand the similarities and differences between the cases (Stake, 1995). The researcher can examine evidence from multiple cases to generalize findings and develop theories (Lewis-Beck et al., 2003). The researcher specifically selected these cases to be included in this study to allow for the generalization of results (Creswell & Poth, 2016).

Pertinent methodologists that use multi-case studies include Creswell (2013), Yin (2003), Stake (1995), Baxter and Jack (2008), Eisenhardt (1989), and Wells (2004). Many researchers often refer to these theorists in their usage of case studies and multi-case studies. Wells (2004) described the core of case studies by stating, "Remember throughout that everyone, even a scientist, thinks in narrative. Science is a story. Tell it" (p. 757). This study will tell the stories of each high school counselor participating in the study.

Research Questions

Based on the review of literature, the conceptual framework, and the theoretical framework, the researcher designed the research questions to focus on school counselors' perceptions of female students exploring STEM majors in college, the processes school counselors use to help these students, and how these practices can be improved. The researcher investigated the following research questions in this multi-case study:

1. What are the perspectives of high school counselors on encouraging female students to explore STEM fields to study in college?

2. What processes do high school counselors apply to these female students, specifically relating to college advising? What are the strengths and weaknesses of these processes? What specific methods can be employed by high school counselors?
3. How can these practices be improved so that school counselors can provide better support for their students?

Methods and Procedures

Setting

The setting of this current study includes four high schools in a suburban region outside of New York City. Two high schools are in the same school district, and two are in separate school districts. The researcher accessed demographic information for each school and district from the New York State Education Department Data Site (NYSED Data Site, 2023). Each high school has students who range in age from 14-19 and are in grades nine through 12. Each district is similar in size, ranging from 4,972 to 5,586 students. The high schools have between 1,162 and 1,873 students. Each high school had approximately equal numbers of male and female students. The four public high schools represented various socioeconomic levels. The researcher used the number of students in each district receiving free/reduced lunch to define economically disadvantaged. The percentage of economically disadvantaged students ranged from 12% to 34%. The differentiation of communities will allow generalization for future research.

The four-year graduation rates vary from 93% to 99% (NYSED Data Site, 2023). Multiple sites illustrate a range of settings to observe to show generalizability.

Generalizability occurred using several participants' perspectives to compare to a larger population (Creswell & Poth, 2016).

The researcher provided pseudonyms to each school to protect their anonymity in this study. Using the date from New York State Education Department Data Site (https://data.nysed.gov, 2023), the researcher compiled information about the schools included in this study. South High School has 5,587 students enrolled in the district; 1,162 students enrolled in the high school; 52% are male, 48% are female, and 23% are eligible to receive free/reduced lunch. Participants 1 and 5 work in South High School. North High School has 5,586 students enrolled in the district; 1,315 students enrolled in the high school; 53% are male, 47% are female, and 20% are eligible to receive free/reduced lunch. Participants 2 and 7 work in North High School. West High School has 5,560 students enrolled in the district; 1,873 students enrolled in the high school; 50% are male, 50% are female, and 34% are eligible to receive free/reduced lunch. Participant 4 works in this high school. East High School has 4,972 students enrolled in the district; 1,558 students are in the high school; 49% are male, 51% are female, and 12% are eligible for free/reduced lunch. Participants 3 and 6 work in this school.

To gain access to the research sites, the researcher used convenience case sampling from a sample she knows professionally, utilizing sites and individuals the researcher can access and collect data (Creswell & Poth, 2016). The researcher gained access to the research site by initially emailing the superintendents of each school district, requesting their approval to gather data for this study within their districts. The researcher then spoke with the directors of guidance for each school or district to explain the study and request their participation. Once the participants volunteered to participate, the

researcher met with each of them individually to explain the study and answer any questions.

The researcher aimed to recognize and address biases related to the setting. The researcher works in one of the high schools included in this study and remained an unobtrusive nonparticipant observer throughout the study, acting as a researcher, not a colleague.

Participants

The rationale for participant selection and the recruiting process is that each participant has worked in the field for at least 10 years, allowing them to be considered experts in advising students on college planning and career advising. The participants work in various locations, allowing for diverse experiences and responses. They all work in public high schools, allowing for similar professional responsibilities. The participants were selected purposively to carefully represent their specific voices and opinions (Vogt et al., 2012). Creswell and Poth (2016) explained that good data collection comes from purposeful sampling, which generates data to allow a researcher to examine the problem best. Sampling this variety of school counselors allows for generalization within the field due to their responses reflecting the larger pool of professionals in the field (Yin, 2018). The researcher asked the guidance directors to speak with their counseling departments to recruit counselors to participate in this study as a method of snowball sampling (Fraenkel et al., 2007; Vogt et al., 2012). One director of guidance and six school counselors agreed to participate.

The participants include seven professional high school counselors who work with students in grades nine through 12. Two counselors from three of the high schools

and one from another high school were included in this study. Each participant has worked in the high school counseling field for at least 10 years.

The researcher emailed each participant to gather demographic and professional context information before the interview. The demographic information collected included each participant's age, gender, and ethnicity. The professional context information collected included each participant's job title, education level, years in current school, years in profession, and number of students on their caseloads. Five of the participants were females, and two were males. They ranged in age from 33 to 51. One identified as Other, and six were White. One was a director of guidance, and six were school counselors. Their caseloads of students ranged from 78 to 248 students. They hold various educational degrees, all holding at least a master's degree and one also holding a professional diploma.

The researcher gave participants pseudonyms to protect their anonymity in this study. The researcher collected this data via email about the participants' demographics, job position, education, years employed at their school, and their student caseloads before beginning the interview process. Participant 1 is a 36-year-old female who identified as White. She is a high school counselor. Her education includes a master's degree. She has worked in this high school for eight years and in the profession for 13 years. She has 185 students on her caseload. Participant 2 is a 46-year-old female who identified as White. She is a school counselor. Her education includes a master's degree. She has worked in this high school for one year and in the profession for 16 years. She has 160 students on her caseload. Participant 3 is a 52-year-old male who identified as White. He is a high school counselor. His education includes a master's degree. He has worked in this high

school for 18 years and in the profession for 20 years. He has 210 students on his caseload. Participant 4 is a 46-year-old female who identified as White. She is a school counselor. Her education includes a master's degree. She has worked in this high school for 22 years and in the profession for 23 years. She has 220 students on her caseload. Participant 5 is a 51-year-old male who identified as White. He is a school counselor and the director of guidance. His education includes a master's degree and a professional diploma. He has worked in this high school for 21 years and in the profession for 24 years. He has 78 students on his caseload. Participant 6 is a 39-year-old female who identified as White. She is a high school counselor. Her education includes a master's degree. She has worked in this high school for 14 years and in the profession for 15 years. She has 210 students on her caseload. Participant 7 is a 43-year-old female who identified as Other. She is a high school counselor. Her education includes a master's degree. She has worked in this high school for 17 years and in the profession for 19 years. She has 200 students on her caseload.

The participants were invited and encouraged to provide their unique and diverse perspectives. The director of guidance can provide broader perspectives, while school counselors can offer more granular responses. Few biases and limitations exist in this study. One bias may exist because the researcher currently works as a high school counselor in one of the schools included in this study. The findings from this study are limited based on the geographic location of participants. All schools in this study are located within the same region and may not accurately represent larger areas with different student populations. The variability within the gender and ethnicity of participants could also limit findings. All but one participant identified as White. Two

participants are males, making up approximately 25% of the sample. The counselors' caseloads in this study are similar, between 185 and 220, except the director of guidance, whose caseload is lower, with 78 students to accommodate his administrative duties. However, the national average caseload is 415 students (ASCA, 2022). ASCA recommends a 250-to-1 ratio of students to school counselors (ASCA, 2022).

Data Collection Procedures

Extensive data collection, which utilized multiple data sources, occurred and allowed for the establishment of construct validity and reliability of evidence in this study (Yin, 2018). Approval from the Institutional Review Board at St. John's University was requested and approved. Approval from each school district was requested and granted. The researcher fully explained the study, its purpose, and its implications for helping others in the future to all participants before asking for their consent before beginning this research study. Data were collected to gather responses to research questions (Vogt et al., 2012). The researcher obtained informed consent from all participants prior to beginning data collection. The researcher included the letter of consent in Appendix B. The researcher maintained participant confidentiality throughout this study. The researcher facilitated all interviews. The researcher stored all data on her password-protected laptop in a locked file cabinet throughout the study. Triangulation occurred using several sources of data collection (Bogdan et al., 2016), which can lead to a strong analysis (Yang & Cornelius, 2004). To demonstrate triangulation of data, the multiple methods of data collection for this multi-case study include in-depth, in-person semi-structured interviews, field notes, collection of artifacts, and surveys of current high school counselors who work with students on college planning and career exploration. The

researcher achieved the corroboration of evidence by comparing responses to interviews, field notes, document analysis, and survey responses.

The interviews occurred in natural settings, without manipulating the environment, during the school day. Depending on the participants' requests, the interviews were conducted in person or virtually in each counselor's office using the videoconferencing platform Webex. The researcher distributed surveys electronically via email. Participant interviews were the primary source of the data and supported by all other methods of data collection.

Additional data collection methods included in-depth, in-person, semi-structured interviews, field notes, online survey responses of current high school counselors who work with students on college planning and career exploration, and the collection of artifacts. The researcher employed multiple methods of data collection to validate findings (Patton, 1990).

Interviews. Yin (2018) suggested that interviews are one of the most important sources of case study evidence, which is why the researcher selected them as a data source in this study. The researchers conducted in-depth semi-structured one-on-one interviews due to a familiar, natural way of gathering information (Vogt et al., 2012). Interviews were selected as a data collection method to examine each of their perspectives by asking participants questions and analyzing their responses (Vogt et al., 2012). Each participant was asked the same questions in the same order to ensure reliability (Vogt et al., 2012). The in-depth nature of the probing interview questions enhanced the validity of responses (Vogt et al., 2012). Questions were open-ended and

exploratory to encourage participants to share their unique and meaningful perspectives in each response and allowed them autonomy in their responses (Bogdan et al., 2016).

The researcher interviewed each participant individually, and the interviews lasted between 24 and 50 minutes, depending on the length of the participants' responses. Throughout each semi-structured interview, the researcher completed check-ins to ensure an understanding of each participant's experience and perspective. One participant requested to meet virtually, so the researcher conducted and recorded that interview virtually using the password-protected videoconferencing platform Webex. Participants consented to the audio recording of interviews when consenting to participate in the study. The interview transcripts were analyzed using MAXQDA software. The data included direct quotes and ideas from the transcribed interviews. The types of interview questions included knowledge-based, to find out accurate information; feeling-based, to understand emotional responses to experiences; opinions, to understand participants' cognitive processes; experience-based, to elicit descriptions of previous experiences, behaviors, actions, and occurrences; and background, to place the subject within a specific setting (Bogdan et al., 2016). The researcher took lengthy field notes during all interviews (Yang & Cornelius, 2004).

The researcher designed the interview questions to allow for free responses from participants. These questions guided the researcher to develop an understanding of the phenomenon (Yang & Cornelius, 2004). The interview protocol (Appendix E) includes the questions the researcher asked each participant. The questions focused on participants' backgrounds, training, experience, support, college advising, and STEM-specific knowledge. When responding to interview questions, participants were

encouraged to describe their perceptions of the gender gap in STEM fields based on their experiences (Yang & Cornelius, 2004). The researcher acted as an unobtrusive nonparticipant observer, recording events or behaviors but not participating (Savenye, 2005).

Field notes. The researcher created extensive field notes as a written account of what she heard, saw, experienced, and thought during in-person interviews (Savenye, 2005). Field notes were descriptive and reflective (Bogdan et al., 2016) and included verbal and nonverbal communication from the participants. The descriptive field notes provided a picture of the setting, people, actions, and conversations the researcher observed. Reflective field notes portrayed the researcher's frame of mind, ideas, and concerns. The researcher recorded these field notes during and immediately following each interview. (Bogdan et al., 2016).

The researcher made audio recordings of each interview. The researcher then transcribed the audio recordings using Trint, an online password-protected transcription service and coded them for themes. The researcher used manual coding to analyze the data (Saldana, 2021) and then confirmed her findings using MAXQDA. The researcher analyzed those themes and drew conclusions. Participants were allowed to review their transcripts and the researcher's field notes for accuracy as a method of member-checking (Vogt et al., 2012). The researcher requested participants' feedback to ensure their experiences accurately represented the interviews via member-checking (Creswell & Poth, 2016).

Surveys. Surveys were electronically distributed via email to each participant to follow up individually to elicit feedback in their own words. Participants could use this

method to reflect on what happened during the interviews. The researcher distributed the surveys one week after each interview occurred. The researcher conducted manual coding and confirmed her findings using MAXQDA software to code survey responses for common themes. Survey prompts include: Since we last met, is there anything you would like to discuss? Has your practice changed since we met? Are there any other points you would like to bring up?

Artifact Collection. The collection of artifacts provided insights to this study (Savenye, 2005). The artifacts that were collected include school profiles from each school, a list of extracurricular clubs and activities offered at each school, and a list of elective offerings for each school with descriptions from the course catalog. The researcher took photographs of each participant's office as an additional form of artifact collection (Savenye, 2005). The researcher collected and analyzed artifacts throughout the data collection process. The researcher collected and evaluated documents to substantiate information gathered during the interviews (Yang & Cornelius, 2004). Artifact collection contributed to the trustworthiness and accountability of the data when combined with the other data sources (Yang & Cornelius, 2004).

The researcher included the interview protocol in Appendix E. Survey questions are included in Appendix F.

The researcher created the interview protocols for this study. The three theoretical frameworks, including Bandura's social cognitive theory (1986), Holland's career theory (1959), Lorber's gender theory (1994), and the conceptual framework, were utilized to develop the interview protocol and survey questions. The researcher designed the interview protocol to allow for authentic responses from participants. These questions

guided the researcher to develop an understanding of the phenomenon (Yang & Cornelius, 2004). The researcher field-tested the interview questions by asking three school counselors not involved in this study to review each item and provide feedback.

The research took approximately one year to complete. The researcher sent drafts to her dissertation mentor for edits and completed several revisions throughout the spring semester. The researcher presented a dissertation proposal to the dissertation committee. Upon successful oral presentation, the dissertation committee approved the proposal. The researcher submitted an IRB application to the Institutional Review Board for approval. Upon approval from the IRB, the researcher began collecting data throughout the school year. The researcher gained site access upon approval from superintendents, high school principals, and high school counselors who agreed to participate in the study in the spring. During the recruitment phase, each participant requested that their interview take place at the end of the school year based on their professional availability. The researcher analyzed data throughout the summer and fall.

Data Analysis Approach

The grounded theory approach is the framework that informs how the researcher derived themes within the data for this study. This approach was selected as this study includes the processes of coding, categorizing, and conceptualizing to construct theories (Vogt et al., 2012). As in the current study, grounded theory is typically used when interview transcripts are analyzed (Vogt et al., 2012). This approach allows the researcher to go back and forth between data collection and analysis (Vogt et al., 2012), which was useful in the current study. The aim of this approach is for the researcher to construct a theory that is *grounded* (Corbin & Strauss, 2008) in data collected from individuals who

have experienced the process (Fraenkel et al., 2007). The researcher does not begin with a theory, but through the data collection and analysis processes, a theory will develop based on the data (Fraenkel et al., 2007). The researcher collected and analyzed data and then developed generalizations after the data analysis (Fraenkel et al., 2007). The researcher used an inductive approach to coding. The researcher developed codes while reviewing the data (Saldana, 2021). This is an ongoing process that the researcher engaged in, and the theory generated may be modified over time (Fraenkel et al., 2007).

The researcher conducted a holistic analysis of data from the entire case (Creswell & Poth, 2016) to answer the research questions and compare similarities and differences among all participants (Yang & Cornelius, 2004). The data analysis process included transcribing, coding, categorizing, thematizing, and displaying data. Through data collection and analysis, a detailed description of each case emerged (Creswell & Poth, 2016). The researcher converted the data collected from verbal responses to qualitative data. The researcher used methods including determining the frequency of words and phrases included. The researcher also used key themes and subthemes to generate and analyze codes (Creswell & Poth, 2016). Detailed case descriptions and themes within each case, a within-case analysis, common themes found across all cases, and cross-case analysis were identified to provide context of the cases.

The researcher conducted multiple cycles of coding. During each cycle, the researcher added other codes and removed others as the researcher uncovered patterns and organized the data into themes (Miles et al., 2020). Those themes were then analyzed, and the researcher drew conclusions (Creswell & Poth, 2016). The researcher analyzed data over three cycles to assign codes and uncover themes. During the first

cycle of coding, the researcher employed In Vivo coding (Saldana, 2021). The researcher conducted this process several times. The researcher selected this initial coding process to analyze direct quotes from participants as codes. Participants' responses were quoted directly (Saldana, 2021). The researcher conducted second-cycle coding to develop a sense of thematic organization from the first-cycle codes. (Saldana, 2021). The researcher selected pattern coding to look for patterns, themes, and relationships in the data (Saldana, 2021). The researcher then continued with a third cycle of coding the data. The researcher transitioned to look within those categories for other themes and patterns. The third cycle of coding selected by the researcher was focused on coding for the researcher to categorize the data further and develop more distinct categories (Saldana, 2021). This method allowed the researcher to compare codes across all "participants' data to assess comparability and transferability" (Saldana, 2021, p. 370).

The researcher employed manual coding and computer-assisted qualitative data analysis software (CAQDAS) to conduct this coding analysis (Vogt et al., 2012). The researcher used MAXQDA software to code interview transcripts and survey responses for common themes. Those results confirmed the researcher's findings from the manual coding process. During each interview, the researcher gathered audio recordings and field notes. The researcher conducted a content analysis using artifacts collected, which included photographs of participants' offices, school profiles from each school, a list of extracurricular clubs and activities offered at each school, and a list of elective offerings for each school with descriptions from the course catalog; to compare each case. Once the researcher reached data saturation, coding ceased. No new information emerged, so the researcher chose to stop coding (Bogdan et al., 2016).

Trustworthiness of the Design

The researcher established the trustworthiness of the study based on qualitative strategies. The researcher employed several methods to ensure trustworthiness. The triangulation of data added to the trustworthiness of the design (Vogt et al., 2012). Triangulation occurred using several sources of data collection (Bogdan et al., 2016) and in many forms. The researcher included a variety of data sources to provide multiple perspectives; the researcher used several theories as a framework to gain multiple perspectives to interpret a single set of data; and multiple methods of data collection, including semi-structured interviews, field notes, survey responses, and artifact collection to study a single problem (Bogdan et al., 2007).

The in-depth nature of the probing interview questions enhanced the validity of responses (Vogt et al., 2012). The researcher recorded the interviews for accuracy (Fraenkel et al., 2019), and participants reviewed transcripts for accuracy and inclusivity (Creswell, 2013) of their interviews as a form of member-checking (Vogt et al., 2012) to confirm the trustworthiness of the data (Morgan et al., 2014). Using In Vivo coding reduces potential biases and represents participants' responses well, as their actual words are data (Saldana, 2021). Participants provided first-hand accounts of their experiences. The researcher achieved validity through comparison with other sources. These perspectives allowed for transferability to other counselors for use in the future.

To strengthen the trustworthiness of the findings, the researcher employed the strategies of triangulation and member-checking. Triangulation occurred through the use of several sources of data collection (Bogdan et al., 2016) and in many forms. The researcher included a variety of data sources to provide multiple perspectives.

Additionally, the researcher used several theories as a framework for multiple perspectives to interpret a single data set; and multiple methods of data collection, including semi-structured interviews, field notes, survey responses, and artifact collection to study a single problem (Bogdan et al., 2007). Each participant reviewed transcripts of their interviews as a form of member checking and provided participant feedback to ensure the accuracy of their perspectives and experiences (Vogt et al., 2012).

Research Ethics

This study fully conforms to the ethical guidelines for research with human subjects. Ethical considerations were maintained throughout this study (Vogt et al., 2012). The researcher sought dissertation proposal approval, including the design and sampling methods for this study (Vogt et al., 2012). The researcher then requested approval from the St. John's University Institutional Review Board (IRB) before beginning the data collection using human subjects (Vogt et al., 2012). The researcher explained to all participants and district administrators that the data collected would be used for research purposes. The researcher upheld the privacy and confidentiality of each participant the duration of the study. The researcher assigned pseudonyms to school districts and participants to ensure anonymity. The researcher requested each school district's permission to allow their employees to participate in this study by emailing each superintendent individually. Once allowed, the researcher spoke with the director of guidance from each high school to explain the study further. The researcher then emailed the guidance staff in each school to request participation. The researcher obtained informed consent from each participant and building principal before they participated in

the study. Participants consented to having their interviews recorded. No human subjects were harmed during this study.

The researcher ensured voluntary participation by explaining to each participant that their participation was voluntary and that they could stop at any time during the study (Vogt et al., 2012). The researcher obtained informed consent per the St. John's University Institutional Review Board guidelines. No pressure or coercion occurred to recruit participants. Participants were not compensated or incentivized for participating in this study (Vogt et al., 2012). Data remained confidential at all times and was stored on the researcher's password-protected laptop in a locked file cabinet to maintain confidentiality.

Each participant was able to review their responses to the interview and surveys at any point. They could read a final copy of the study if they chose. Prior to consent, the researcher explained to each participant that this study was only for research purposes.

Researcher's Role

The researcher acted as a non-obtrusive participant-observer. The researcher created the interview protocol and survey questions, conducted all interviews, and distributed the surveys. The researcher analyzed and coded all data. The researcher maintained dual roles as researcher and practitioner throughout this study (Vogt et al., 2012).

The role of the researcher includes the director of the study, collector of data, interviewer, and data analyst (Stake, 1995). The researcher is a female, 44-year-old White high school counselor working in the field for 20 years at one of the high schools in this study for 17 years. She maintained the utmost professionalism throughout the entire

study. The researcher did not allow her personal experiences or perspectives to be included in the study's data collection or data interpretation processes.

The researcher works in the same high school as two of the participants of this study. The researcher remained neutral. The researcher maintained anonymity and confidentiality throughout this study. The researcher recognized and addressed any biases related to her role by being mindful that she works in one of the high schools included in this study. Throughout this study, she remained an unobtrusive nonparticipant observer, acting as the researcher, not a colleague.

Conclusion

The current study explored how high school counselors influence the choices of STEM majors for female students. This chapter outlined the research design, research questions, methods, and procedures, including setting, participants, data collection procedures, data analysis approach, the trustworthiness of the design, research ethics, and researcher role. The next chapter reviews the results of this study.

CHAPTER 4

Introduction

In this study, the researcher explored multiple perspectives of high school counselors regarding their work with female students interested in the STEM fields through the lenses of Bandura's social cognitive theory (1986), Holland's career theory (1959), and Lorber's gender theory (1994). The aim of this study was to explore how high school counselors influence the choices of STEM majors for female students. Other high school counselors can use these perspectives to inform on how to best support their female students considering pursuing STEM fields to study in college and as career opportunities.

This chapter presents the findings from the data collected during interviews with high school counselors, field notes, artifact collection, and survey responses. These participants include seven public high school counselors from four suburban school districts outside New York City. Two high school counselors from three of the four high schools and one counselor from another high school in this suburban region participated I this study. Data collection occurred during the spring and fall semesters of 2023.

The following research questions guided this study:

1. What are the perspectives of high school counselors on encouraging female students to explore STEM fields to study in college?
2. What processes do high school counselors apply to these female students, specifically relating to college advising? What are the strengths and weaknesses of these processes? What specific methods can be employed by high school counselors?

3. How can these practices be improved so that school counselors can provide better support for their students?

The participants in this qualitative multi-case study provided their perspectives as high school counselors on encouraging female students to explore STEM fields in college and beyond. They responded to each question and provided thorough responses to each prompt.

Each interview lasted between 24 and 50 minutes. The researcher conducted the interviews for Participants 1, 2, 3, 6, and 7 in their offices. Participant 4 was interviewed virtually using the videoconferencing platform Webex. The researcher interviews Participant 5 in another counselor's office.

Results/Findings

The researcher presents results and findings from the one-on-one, semi-structured interviews, participants' responses to surveys, the researcher's field notes, and artifacts collected by the researcher in this section. Each participant, their principal, and superintendent provided consent for the researcher to conduct the interviews. Each interview was recorded on the researcher's password-protected laptop and transcribed using Trint, a web-based password-protected audio transcription service. The researcher sent each participant a copy of their transcript as a form of member-checking for accuracy, to which each participant agreed with the accuracy of their transcript.

Study participants included seven school counselors who work in four public schools in suburban school districts outside of New York City. Total district enrollments for schools included in this study ranged from 4,972 to 5,586 students. The number of students enrolled in each high school ranged from 1,162 to 1,873. The percentage of

males in each school ranged from 49% to 53%, and females ranged from 47% to 51%. The percentage of students receiving free/reduced lunch ranged from 12% to 34%.

The participants ranged in age from 36 to 52. Five participants were female, and two were male. Six identified as White, and one identified as Other. Six participants were school counselors, and one was a director of guidance. All seven participants held master's degrees, and one also earned a professional diploma. Their work experience ranged from 13 to 24 years in this profession and from one year to 22 years in their current schools. Their student caseloads ranged from 78 to 220.

The artifacts collected by the researcher include photographs of each participants' office, school profiles for each high school, lists of elective course offerings from each high school, and lists of clubs/extracurricular activities offered by each high school. School profiles include contact information, community and school information, curriculum, grading and ranking procedures, test score information, college attendance history, extracurricular opportunities, and any additional "important information or data that helps differentiate" each high school. (https://counselors.collegeboard.org/counseling/advising/school-profiles/create, 2023)

The researcher took photographs of each participant's office and stored them on her password-protected laptop. The researcher obtained school profiles, lists of elective course offerings, and lists of clubs and extracurricular activities from each high school's website.

The researcher contacted participants via email one week after their interviews. The questions in that email included: Since we last met, is there anything you would like

to discuss? Has your practice changed since we met? Are there any other points you would like to bring up?

In response to the first question, Participant 6 wrote, “Since we last met - I did reach out to two of my former engineering female students to let them know I'm thinking of them. I'm looking forward to hearing back!” The other participants did not respond to that prompt.

Regarding the second question, Participant 2 shared,

> My practice will change. I can't ignore the point you brought to my attention, which focused on how I address STEM with female students. Your study raises the point that young women could use assistance and encouragement to consider STEM-related fields.

The other participants reported no changes to their practice.

Responding to the third question, Participant 1 shared,

> I’ve been mindful to share with my colleagues about the topic of women in STEM fields and facilitate discussions about how we can increase their involvement! It has come up naturally in conversations about certain things and a nice thing to bring awareness to.”

Participant 6 shared, “No other points - I appreciated the opportunity to reflect on my practices.” The other participants had no responses to that prompt.

Interview coding resulted in eight emerging themes from qualitative data analysis. Three themes emerged related to the research questions. Three themes emerged related to research question 2. Two themes emerged related to research question 3. This section

includes the findings of this study using descriptive excerpts and In Vivo quotes from the participants' responses to interview questions to answer the research questions.

The interview protocol included multiple questions that assessed high school counselors' perspectives on encouraging female students to explore STEM-related fields to study in college. Each of the seven participants was asked the same questions, in the same order, about helping their students pursue STEM interests to maintain standardization.

Research Question 1/Theme 1

What are the perspectives of high school counselors on encouraging female students to explore STEM fields to study in college?

The interview questions related to this research question include the following:

- Describe what you believe to be the most important responsibilities of a high school counselor.
- What sources of support do you have?
- This study is looking at the gender gap in STEM majors and careers. Do you see this as an issue? Can you give any examples?
- How do you know if students are interested in STEM areas?
- How familiar are you with STEM majors and careers? How could you learn more about those?
- Do you know the different types of engineering disciplines and pathways? How could you learn more about those?

The themes that merged from participant responses about STEM areas include establishing relationships, sources of support, and counselor knowledge.

The Theme of Establishing a Relationship

A theme that emerged among all seven participants is the importance of building a relationship between the school counselor and the student. The results of this study show that for school counselors to assist their students in career and college exploration, a relationship must first be established between the counselor and the student. Once counselors establish those relationships, they can better support each student throughout high school and prepare students for their futures. The researcher noted that participants seemed positive and enthusiastic when describing this relationship in her field notes. Subthemes that emerged from this theme include interpersonal support and individualized planning.

Interview question: Describe what you believe to be the most important responsibilities of a high school counselor**.** All seven participants stated that establishing a relationship with each of their students is their most important responsibility. Participant 1 shared, "…relationships and connections with students…so we can work together to make it a better experience for the kids." Participant 2 said, "The bond that you form with them…Just showing genuine interest and support for their emotional needs or problems. And then everything academic comes a little bit later." Participant 3 stated, "Helping kids through whatever social and emotional issues they're facing is imperative." Participant 4 said,

> …to make sure that the student knows that they have an ally, to make sure that they know they have a door they can walk through, they have an office they could feel safe in, and somebody they can confide in when they might not feel that way outside of these walls.

Participant 5 said,

> …to connect with the kids and know the pulse of the building and for them to know that they have an advocate in guidance; somebody who they can go to, who is not always going to agree with them, sometimes challenges them, but knows that ultimately that person is in their corner looking out for their best interests. We have to be approachable [and] non-judgmental, but again, not afraid to push students and have them, you know, push their limits too.

Participant 6 said, "…to be a student advocate. Helping students understand what is in their best interest and advocating for such is essential." Participant 7 said, "the most important responsibility is just being there to support students in any way. So that could be social-emotional, it could be academic. It varies for each student and it's usually a combination of both."

The Theme of Sources of Support

Interview question: What sources of support do you have? Sources of support that participants felt were helpful in working with students included collaboration with others. Subthemes from this theme include colleagues, supervisors, and college relationships.

All participants shared that their colleagues are sources of professional support. Participant 1 shared that her sources of support include an outside agency, colleagues, supervisors, families, administrators, and relationships with college admissions personnel. Participant 1 stated, "We work really well together, and we support each other and definitely a team approach." Participant 2 also feels supported professionally. Those sources of support include her colleagues, and she said, "I know I can ask anyone a

question. Everyone is very approachable…I know I'm new." She also shared that she receives support from her coordinator, administrators, and friends.

Participant 3 shared that parents and students are supportive. He said, "You know, it really is a nice place to work." He also said his director of guidance, school psychologists, and social workers are sources of support. Participant 4 said her colleagues, supervisor, assistant principals, superintendent, social workers, and psychologists are supportive. Participant 5, a director of guidance, in addition to his role as a school counselor, shared, "We have a terrific department. They're motivated. They still have the kids' best interests in mind. The school's best interests in mind. So, from that perspective, I couldn't ask for more." He added his administration is supportive. He said, "I think they respect what we do." He said parents are supportive and added, "They value education." Participant 6 said, "Definitely colleagues…We bounce ideas off of each other all the time." She added that her director of guidance, assistant principals, and district-level administrators are supportive. Participant 7 said her colleagues, administrators, and families are sources of support.

In the post-interview survey, Participant 1 wrote,

> I've been mindful to share with my colleagues about the topic of women in STEM fields and facilitate discussions about how we can increase their involvement! It has come up naturally in conversations about certain things and a nice thing to bring awareness to.

This finding corroborates the previous evidence of collaboration among her colleagues and strengthens the trustworthiness of the study.

The Theme of Counselor Knowledge

Regarding the theme of counselor knowledge, participants responded to if they see the gender gap in STEM majors and careers as an issue, their own STEM-specific college and career knowledge, their awareness of their students' interests, their knowledge of specific STEM majors and careers, and how they can learn more to enhance their knowledge. Subthemes that emerged from this theme include awareness of the gender gap, the awareness of students, and willingness to learn.

Subtheme of Awareness of Gender Gap

Interview question: This study is looking at the gender gap in STEM majors and careers. Do you see this as an issue? Can you give any examples? All participants, except Participant 7, see a gender gap in STEM areas. Participant 1 sees a gap in STEM majors and careers. She shared, "They are the minority…definitely not really as many as the males." Participant 2 also feels there is a gender gap in STEM fields. She said, "Definitely." She said the administration in her previous school saw this and addressed it by beginning to offer new programs and diploma designations to encourage students to take additional courses. Participant 3 said "Yes. When I do have girls who want to pursue those majors, though, to me, they stand out more than memorable."

When discussing classes, Participant 3 said, "Anytime I have a female who takes Physics C, it's a standout for sure." Participant 4 said, "I definitely agree [regarding students selecting specific courses]. I'm finding that's a little bit more popular now, then I make it a point to recognize that." Participant 5 said, "I guess it [students selecting specific courses] is…I don't think you hear STEM as much as you hear it with the males.

Yeah, there's a difference." Participant 6 said, "We have a Robotics team. I'd say it's predominantly male, and I can think of one female student this year that stands out."

Unlike the other participants, Participant 7 said she does not see a gender gap. She said,

> I don't really see much of a difference in [the] gender gap between students applying for majors. I think in this school we have a lot of very interested girls and boys. I do not feel that one is over the other. I see it just as much with girls as with boys.

Interview question: What STEM-specific college and/or career knowledge do you have? Most participants agreed that they lack STEM-specific training. When discussing this issue, the participants sounded frustrated, which the researcher included in her field notes. Regarding her level of STEM-specific college and career knowledge, Participant 1 shared, "Never enough [STEM-specific college and career knowledge] …I can always learn more. Learning more about those fields and the specifics of them is definitely something I could improve on. I'm totally not familiar with that."

Participant 3 shared that he has learned about these fields from visiting college campuses, specifically seeing robotics labs, and engineering departments, and speaking with professors and admissions personnel.

When discussing her STEM-specific knowledge, Participant 4 said, "I have to be honest, I really don't [have much], because I don't have kids that ask for those schools." She added, "Colleges have to come further now. Like, train us."

Participant 5 said, “I wouldn’t say I’m an expert in STEM, but certainly from experience, you know the schools that are strong in the field.” Participant 7 said similarly, “I have some, but it’s not like an area of expertise.”

Diverging from other responses, Participant 2 said that since she was a math major in college, “I think I’m much more willing to bring that up with students if a student doesn’t know what they’re looking for in STEM.” Participant 6 also shared that she was on a pre-med track in college, so she has some knowledge of these areas. In her field notes, the researcher indicated that all seven participants were open to sharing what they do not know, demonstrating their vulnerability and willingness to acquire more knowledge to serve their students better.

Subtheme of Awareness of Students

Interview question: How do you know if students are interested in STEM areas? Counselors build upon their already established relationships with students to know if students are interested in STEM areas. Participant 1 asks students about their interests, passions, goals, plans, and strengths. She responded,

> Just by getting to know the kids and point-blank asking them. We ask, like we point out. We ask them questions like that. ‘What are you interested in?’, ‘What are you passionate about?’, ‘What would you like to do in life?’, ‘What would you like as a career?’, [and] ‘What are your strengths?’ If they do share that, their strengths are more in math and science. Certainly, [it is] something we would talk about. So really, just by getting to know the kids and point blank asking them and having them complete those surveys that identify their strengths and so forth.

Participant 3 also agreed when he said, “Conversations with us about what they enjoy doing.”

Each of these high schools utilizes Naviance for college search and career exploration assessments and activities. Several participants said they utilize career assessment results to determine whether students are interested in STEM areas. Participant 2 shared that she uses Naviance career assessment results.

Several participants said they look at students’ courses and extracurricular activities to determine if students are interested in STEM areas. Participant 2 looks at academic strengths and students’ participation in specific clubs and organizations. She said,

> I guess, obviously, if they have strong grades, if they're in honors classes in those subjects, if they're interested in different clubs and organizations, and obviously through assessments, I would find out if STEM was on the radar for them.

Participant 3 said, “They tell us, but we see it in many ways.” He added that their courses and activities indicated their interests. Participant 4 said the courses they selected demonstrated their interests. She added, “We also don’t have a lot of engineering opportunities at the high school. We have one class. So, I don’t think our students, male or female, are given the full range.” Participant 5 also said he could see their interest based on the classes they took. He said,

> [I know their interests] …just from what they’re doing in school. What they want to take, how they do in their science and computer science courses. And, if they’re excited about continuing those disciplines at a higher level, it usually

gives you a pretty good indication if it's something they want to pursue. I think that part is pretty clear.

Participant 6 said, "[I understand their interests] based on their electives." She added, "Just a regular conversation around their interests" allows her to learn about their interests, passions, and hobbies. Participant 7 said she discusses students' course selection and their grades in their classes to assess their interests. She shared, "[I do this by] looking at schedules and helping kids with course selection, understanding what is important for whatever their future plans are."

In her post-interview survey, Participant 2 wrote,

> My practice will change. I can't ignore the point you brought to my attention, which focused on how I address STEM with female students. Your study raises the point that young women could use assistance and encouragement to consider STEM-related fields.

This statement demonstrated her ability to self-reflect and continue evolving her practice to help her students better.

Subtheme of Knowledge of STEM

Interview question: How familiar are you with STEM majors and careers? How could you learn more about those? Do you know the different types of engineering disciplines and pathways? How could you learn more about those? Regarding familiarity with STEM majors and careers, many participants said they do not know enough about STEM specifically and offered ideas on how they could learn more. In her field notes, the researcher noted that all seven participants seemed eager to learn more. Several participants offered personal anecdotes that provided context to their responses.

Participant 1 said, “No, I don’t know enough.” Participant 2 shared that to learn more, visiting colleges and meeting with personnel in STEM programs would be helpful. She said, “A rep [representative] came in to talk about a program and what kinds of students they were looking for.” Participant 3 said he learned specifics about STEM majors and careers from visiting colleges and learning about the opportunities they offer. He offered an idea to help learn more by speaking to professionals in different fields and offered to speak with his students. He said, “I’d love to get an aerospace engineer or a nuclear physicist to come in at a career day and talk about what they do, maybe even if it was a female, even better.” Participant 6 also suggested holding an event in conjunction with their annual career day, specifically inviting female representatives from the STEM fields to speak to students. Participant 4 said, “I think I need to learn more about them [STEM fields]. I don’t know too much. I would like to learn more because I think that would also help.” Participant 5 said, “I’m familiar, but I’m not a STEM expert.” Participant 7 also said she does not know much about STEM specifics but is interested in learning more, specifically through visiting colleges.

Participant 6 deviated from the others by sharing her knowledge of STEM majors due to her own experiences. She shared, “I was on a pre-med track back in college, so I know some things.”

Subtheme of Willingness to Learn

Interview question: Do you know the different types of engineering disciplines and pathways? How could you learn more about those? Each participant responded with suggestions on furthering their knowledge of engineering disciplines and pathways. None of them had an issue sharing when unfamiliar with these fields and were open to learning

more about them. In her field notes, the researcher noted that participants conveyed their vulnerability and lack of knowledge in certain areas and their interest in learning more to better serve their students. Several participants offered personal anecdotes that provided context to their responses.

Participant 2 said "taking courses" can enhance her knowledge of STEM careers. Participant 3 said, "I'm not an expert in describing what each particular pathway is like." He suggested a way for counselors to learn more about those could be to speak to the head of his science department about the different types of engineering. He added that visiting colleges, speaking to the head of departments, and seeing their programs could be helpful. Participant 4 suggested that colleges invite school counselors and students visit their campuses and look at their programs. She said the "hands-on" aspects of these visits are essential. She said it is critical to focus on the labs, facilities, and technology when looking at STEM majors. She said, "You want to make sure it's all up-and-coming, and they have the money to sustain them." Participant 5 said, "I mean, I know of them. I can certainly learn more. I'm not an expert on the different branches. I'd be interested to know [about specific STEM areas]." Participant 7 also said she understands "the basics. I can talk to a student about them." She added, "I'm happy and open to learning more."

Several participants alluded to having some knowledge, but they are still willing to learn more. Participant 6 said, "My college roommate was a female chemical engineer major, but that's really the extent of my knowledge." She also shared that she has spoken with her colleague who teaches engineering courses to help her students. Participant 7 shared, "We have an introductory course where you learn about the difference between, you know, chemical, mechanical, [and] electrical. And, I've spoken with the teacher

about that. I've read the description." Participant 4 said she is somewhat familiar with the different types of engineering pathways.

Research Question 2/Theme 2

What processes do high school counselors apply to these female students, specifically relating to college advising? What are the strengths and weaknesses of these processes? What specific methods can be employed by high school counselors?

The interview questions related to this research question include the following:

- *Do you help match your students with specific majors?*
- *What about STEM specifically?*
- *Do you or does your school currently do anything to increase females pursuing STEM majors?*
- *Do you see a gap? And if so, how can you decrease it?*
- *What real-life STEM opportunities are available to your students?*

The researcher included these questions in the interview protocol to determine the specific processes counselors employ when working with their students on academic and career counseling, specifically relating to STEM areas. Three themes emerged from participant responses about STEM majors and career advising. Those include ways to shrink the gap, career assessments, and STEM opportunities available.

The Theme of Career Assessments

Interview Question: Do you help match your students with specific majors? Regarding career counseling activities, many of the participants conduct career assessment activities with their students and discuss the results with them. All four high schools in this study use Naviance as a career exploration resource. Several participants

offered personal anecdotes that provided context to their responses. Subthemes emerging from this theme included Naviance, individualized planning, previous personal experiences, and alumnae.

Participant 1 said she utilizes career interest surveys and has conversations with students to "Find your passion and figuring out what you like." Participant 2 uses the Cluster Finder quiz on Naviance. She discusses the results with students to get a "good ballpark sense of what the industries are and how they kind of fit into what you're thinking." She uses these results to "help them understand that their hobbies, their interests can lead to certain careers." Participant 2's goal for her students is to "know what they're good at, what they like, and how to connect that to a career. So, if they're willing to put in the work, we can really help them a lot." Participant 3 also uses the Naviance Cluster Finder "to see what students are interested in, and that can tie those strengths and interests to particular majors and then ultimately to particular colleges." Participant 4 said she speaks with students individually about their interests. She also utilizes interest inventories. Participant 5 said he conducts career inventories and looks at the results with his students. He said, "We have conversations based on it, but we also validate their uncertainty when they have it, that it's okay." He added, "I think it's good for them to have an idea. But I also think it's okay if they don't know. College is always a good time to figure that out." Participant 6 said, "We talk through different ideas" when working with students on career advising. Participant 7 also said, "We'll talk about majors based on their interests."

Interview question: What about STEM specifically? Participant 1 shared that computer science is "definitely one that is very popular." in terms of STEM-specific

majors. Participant 2 said that as a math major in college, she is a "product of a STEM field," so she may have more knowledge of this based on her previous personal experiences. Participant 3 said he discusses academic requirements with students interested in studying engineering in college. He said he differentiates recommendations depending on the student's academic level, "We try to recommend the appropriate levels of Math and Science for them." Participant 4 said she gives students ideas of colleges that offer specific STEM majors and career options for students who pursue STEM majors. Participant 5 said, "I personally avoid stereotyping." Participant 6 said,

> I can think of a handful of female students, maybe even one per year, that we've had extensive conversations about because they've been torn between a technical institution versus a different sort of setting, with the concern that it would be so male-dominated. And form a social perspective, how would that work for them? These are very well-rounded kids who really love engineering.

Participant 7 said, "I think they really have to figure out where their interests lies." She added, "I say to the kids, 'It's not my area of focus'. They have to figure that out. Do their research."

The Theme of Shrinking the Gap

Interview question: Do you or does your school currently do anything to increase the number of females pursuing STEM majors? To increase the number of females pursuing STEM majors, participants build on their established relationships with their students and discuss their interests and extracurricular activities with them. Subthemes that emerged from this theme include encouragement, a variety of hands-on opportunities, individualized planning, and mentors.

Participant 1 said, “We try to emphasize and to get kids involved in classes and clubs.” Her school offers classes and clubs such as Robotics, Computer Science Club, and Girls Who Code. However, she shared that “They’re not always well-attended.” Participant 1 shared,

> It’s [lack of attendance] something our student body has tried to address. There is a club called Girls Who Code to try and empower them that they kind of promote here and try. So, I’ve had students be leaders in that and talk with them about it, and it’s not a widely attended club.

Participant 3 said his school also has a Girls Who Code club, which is well-attended. Participant 2 said, “It’s funny when I walk into the Robotics room, it’s definitely male-dominated, so that could be a place to start.” Participant 3 said, “There’s nothing that we do to market specifically for girls.” He shared that they “have many female staff members who are science teachers,” suggesting that they act as role models to female students. Participant 5 said, “I think by the course offerings alone, we’re doing that…just organically. Yeah, it’s happening because of the math and computer courses we have.” Participant 6 said her school has a Robotics club and offers classes related to Engineering. When looking at increasing the number of female students interested in pursuing STEM interests, Participant 7 said, “Not that we feel we need to specifically address.” She said her female students are involved in their Science Research program, the Robotics program and taking high-level AP Physics courses. She added, “I don’t think it’s an overall sense from our staff or from each other that our females are not in the STEM classes.”

Interview question: Do you see a gap? And if so, how can you decrease it? All participants, except Participants 2 and 7, see some sort of gender gap in their female students interested in STEM areas.

Participant 1 said, "STEM is a male-dominated field." and suggested a way to lessen the gender gap in those areas is to "having more awareness and education about the gaps…and opportunities like Girls Who Code…and those experiences…and spreading awareness about these types of programs can only help." Participant 3 joked, "I think the gap is narrowing, but I do still see a gap. How do I fix it? If I had that answer, I'd be running the U.S. Department of Education." He suggested encouraging students in elementary school to participate in STEM activities. He said students interested in Legos and Rubik's Cubes should be encouraged to utilize those "math and analytic skills." He added marketing STEM clubs to elementary and middle school girls to help narrow this gap. Participant 4 said she sees a gap "in the engineering component…because our students, like I said earlier, the females are not taking those courses. I think there are more females now interested than had been in the past." To resolve this issue, Participant 4 suggested offering a program to demonstrate "what you can do with a STEM degree." Participant 5 acknowledged the gender gap. He suggested in his school, "cultural expectations" impact students' decisions. He said, "Having them keep an open mind, having the conversations, asking parents to have an open mind and not pigeonholing their daughters." Participant 6 sees a gender gap and suggested having a female role model, "I think having a female role model to look to…highlighting the attributes or the contributions that females have made." Unlike the others, Participant 2 said she does not see a substantial gender gap in STEM areas in her students. She stated, "I know a lot of

my female students are interested in those [STEM] subjects." Participant 7 said, "I don't really see that here [at their school]."

The Theme of STEM Opportunities Available

Interview question: What real-life STEM opportunities are available to your students? All seven participants said that their school offers their students real-life STEM opportunities. They include electives, individual course selection, internships, shadowing, career day, summer programs, mentoring, and career interest inventories.

Participant 1 said "We do career inventories to [with] all students in 10th grade. We have clubs, courses, internships, jobs posted on a job board on the guidance website, and summer programs. We try to embrace those things." Participant 2 said her school offers electives, and she recommends summer programs to her students. Participant 3 said his school offers "all of the above," meaning individual course selection, internships, shadowing, summer programs, mentoring, and career interest inventories. Participant 4 said they have a Computer Club and Robotics Club. She added that they share opportunities for summer programs with their students. Participant 5 said they offer clubs and share information about summer internships and opportunities that they post on their website and send to students. Participant 6 said her school offers internships, but "they tend to be business related." She added that they have a Robotics track, consisting of three courses where students can earn college credits upon completing. They also have a Robotics team. Participant 7 said they offer specific courses, internship programs, and shadowing days at a local hospital and added, "But it's up to students whether they choose to sign up for it."

Content analysis of publications from each high school's websites aimed to answer questions about opportunities for students to pursue STEM interests. The researcher included eight documents in the content analysis. Those documents include a list of extracurricular clubs and activities and elective courses offered by each of the four high schools in this study. A code that emerged during content analysis includes STEM opportunities available to students. The analysis of these documents illustrates a variety of hands-on opportunities afforded to students. The theme that emerged from this content analysis contributes to the trustworthiness of this study.

The researcher collected a list of all electives offered at each of these high schools and then narrowed it down to STEM-related courses. Schools in this study offer between 5 and 11 STEM-related elective courses. Students can earn a full credit (1.0) or a half credit (.5) in each course. South High School is the only high school to require a computer or technology course. Students there are required to take .5 credits in those areas. It is noteworthy that South High School is the only school with that requirement, and they offer the least number of these courses, with 5.

West High School offers 11 STEM electives. Those include Intro to Computer Science (1.0), Java Programming (1.0), AP Computer Science (1.0), Intro to Cybersecurity (1.0), Technical Design and Innovations (CAD) (1.0), Computer Aided Design 2 (1.0), Computer Aided Design 3 (1.0), Electronics 1 (1.0), Electronics 2 (1.0), Principles of Engineering (1.0), and Robotics (1.0). West High School does not require students to take any STEM elective courses.

South High School offers 5 STEM electives. Those include Intro to Computer Science (.5), Intro to Computer Science 2 (.5), AP Computer Science (1.0), Robotics 1

(.5), and Robotics 2 (.5). South High School requires all students to take .5 credits in these subjects.

East High School offers 8 STEM electives. Those include Design and Drawing Production (1.0), Robotics (1.0), Modern Manufacturing (.5), College Engineering (1.0), Computer Repair 1 (.5), Computer Repair 2 (.5), Aeronautics (1.0), and Careers in Engineering (.5). East High School does not require students to take any STEM elective courses.

North High School offers 9 STEM electives. Those include PC/A Certification (.5), Intro to CAD (.5), Robotics (1.0), Advanced Robotics (1.0), Intro to Engineering (.5), Intro to Programming and Java (1.0), AP Computer Science (1.0), Data Structures (1.0), and Game Development (1.0). North High School does not require students to take any STEM elective courses.

The researcher collected a list of all clubs and extracurricular activities offered by each high school and then narrowed it to STEM-related options. She obtained that information from each high school's website. Schools in this study offer between 6 and 16 STEM-related clubs. West High School offers 6; South High School offers 16; East High School offers 7; and North High School offers 10.

West High School offers Computer Club, Robotics, Science Club, Science Research Club, Science Cares Club, and Tech Advisor to the Newspaper. South High School offers Active Minds Club, Architecture Club, Artificial Intelligence Club, Astronomy and Physics Club, Bio-Ethics Club, Computer Science and Game Development Club, Data Science Club, Engineering Club, Girls Who Code Club, Makerspace Club, Math Team, Pre-Med Club, Project Earth Club, Robotics Team,

Science Olympiads, and Scientific Experiments and Analyses Club. East High School offers Robotics, Environmental Club, Math Honor Society, Mathletes, Science Honor Society, Science Olympiad, and Techies. North High School offers Architecture Club, Astronomy Club, Computer Programming Club, Envirothon Club, Math Team, National Science Bowl, Physics Club, Pre-Med Club, Robotics, and Science Olympiad. The only club that all four participating high schools offer is Robotics.

Therefore, coded themes that emerged during data analysis suggested different opportunities offered to students by each high school. Each of these high schools provides hands-on academic opportunities for their students, as demonstrated by this data.

Research Question 3/Theme 3

How can these practices be improved so that school counselors can provide better support for their students?

The interview protocol included questions to find out how practices employed by counselors can be improved. The interview questions related to this research question include the following:

- *What professional development opportunities have you received during your tenure?*
- *What additional training do you wish you had?*
- *What STEM-specific college and/or career knowledge do you have?*
- *What additional training and/or support would help you in this area?*
- *What tools do you wish you and/or other counselors had?*

- *If you could help other counselors, what suggestions would you make for working with female students interested in STEM?*
- *Is there anything that you would like to share about your role as a school counselor that I haven't asked?*
- *If you could change anything in college admissions, what would you change and why?*

Two themes emerged from the participants' responses about improving their practice. Those themes include professional development opportunities and helping others.

Theme of Professional Development Opportunities

Interview question: What professional development opportunities have you received during your tenure? A pattern shared by several participants included that professional development opportunities their school and district offered are typically not geared toward school counselors' needs. Subthemes emerging from this theme included irrelevant professional development, suggestions, campus visits, obstacles, and additional training. The researcher noted frustration in some participants' verbal and nonverbal responses in her field notes. Participant 1 shared, "Our professional development is typically geared towards teachers." She shared "Our faculty meetings are pretty centered on teacher professional development here. And it doesn't really relate to us as counselors." Participant 6 said that she has received training on IEP writing through her district, which constitutes a small portion of her role.

Many participants said visiting college campuses is a substantial form of relevant and useful professional development. Participant 2 shared that she attends college

admissions workshops and annual college breakfasts and takes courses to continue learning. Participant 3 shared that he is required to take 12 hours of professional development each year. He said there is a budget to allow counselors to go out and visit colleges. He said, "Ideally, I'd love to visit 10 to 15 schools every year." He said he attends conferences, including NACAC (National Association for College Admission Counseling). He is also a member of advisory boards for colleges and visits those campuses. Participant 4 said she visits colleges for her professional development. Participant 5 shared that he attends college luncheons and visits colleges to learn more. Participant 6 added that she seeks to learn more about changes in college admissions and mindfulness. Participant 7 said she can sign up for conferences, college visits, meet with college representatives when they visit her students, and read updates colleges send out.

Participant 1 said, "It's things that I find. It's webinars that I have kind of located. So, it's seeking it out yourself." Funding professional development is not an issue for Participant 1. She said, "They'll [the school] pay for it, and it's great."

A hindrance to receiving professional development shared by several participants includes the inability to attend conferences. Those obstacles include time, funding, bureaucracy, and overturn in admissions personnel. Participant 1 said, "It's conferences [that] I'm able to attend." Participant 5 said an obstacle impeding his learning is time and his responsibilities. He said, "I feel like there's always something going on. It's tough to leave the office." Participant 7 shared, "I can't leave to go. I wish I could." She reflected:

> [I wish I had] the ability to more easily attend conferences. Sometimes I don't find out about them until right before and just red tape kind of stuff makes it hard sometimes to get approval to go on them, especially if they cost money.

Participant 6 added,

> We build college relationships, and the reps [representatives] change. Some of them with frequency, so it's sometimes hard to keep up with the schools where we send a lot of kids to. We work really hard to maintain those relationships.

An obstacle to receiving sufficient training is time. Participant 1 said a way to learn more about STEM fields is to research these topics and said, "We could spend so much of our day if we really wanted to, trying to learn about every program that every school has. But sometimes you just can't do that," suggesting that time is a valuable resource in demand. In her field notes, the researcher indicated that participants 5 and 7 were frustrated when responding. It is noteworthy that they both work in the same school district and shared that they have difficulty accessing professional development opportunities.

Interview question: What additional training do you wish you had? All seven participants offered suggestions in response to this question that could better help them serve their students. Participant 1 would like to receive professional development in the areas of mental health, social media, and technology. Participant 3 also said he would like more "clinical or mental health training." He said, "I mean, we're not clinicians, but it's always nice to get the latest in terms of therapeutic approaches." Participant 6 said she would like additional training in "cognitive behavioral therapy and other specific therapies to help my students." Participant 2 said she would like to receive professional development in special education and ESL curriculum. Participant 4 also said that she would like to receive more training in special education. She added she would like more training on Naviance and changes in graduation requirements. As the director of

guidance, Participant 5 is closely involved with hiring guidance interns and school counselors. He suggested that graduate programs should offer more practical experiences as opposed to theoretical ones. He said, “Like more college counseling because that’s a priority.” The researcher noted in her field notes that all seven participants are willing to learn more, even as seasoned professionals in their careers.

Interview question: What additional training and/or support would help you in this area? When discussing this issue, participants seemed enthusiastic when they listed the training and support they would like to receive. They each seemed open to continue learning, even as some were decades into their careers and approaching retirement. The researcher took note of this enthusiasm in her field notes.

All seven participants shared that they could learn most from visiting colleges and speaking with admissions personnel and alumnae of their high schools. Participant 1 shared, “Learning from the colleges directly, and what they offer and how that impacts the different career choices.” She added, “I can understand better how to guide students who express passion for certain careers.”

Participant 2 said she likes to speak with alumnae and shared an experience at her previous school with a physics teacher who taught her about the different types of engineering. She also said she would like to attend STEM-specific events “that could make us feel more confident in promoting STEM for our students.” Participant 3 said that when he visits college campuses, he thinks “meeting with professors in the field or visiting science labs” can help counselors learn. He added, “Sometimes it’s nice to see those spaces firsthand and to hear from those people firsthand, rather than just the admissions folks.” Participant 4 said she would like colleges to “reach out to the high

schools and give us information so that we could pass it on. I think that if they gave information about these specific programs, we can push them more and learn about them." Participant 5 said, "Getting out to schools more, having time to have conversations with reps. Having time to attend their luncheons or whatever they're offering because those are always valuable. A lot of times they also bring in representatives from their academic departments." Participant 6 said visiting campuses is her preferred method of learning. She said, "Seeing the labs is better than hearing about it. When you see it, it's really like another level. When you visit those spaces, you learn more about it." Participant 7 also shared, "Just visiting more schools, looking at what their programs are, understanding those differences."

Interview question: What tools do you wish you and/or other counselors had? Participant 1 said, "Learning more about what the programs are that are available to them so that we can kind of guide them to try." She added, "More awareness or education is the biggest part of it." Participant 2 said she wishes she had more time to spend with students. Participant 3 said mentors could help. He also said counselors could contact alumnae to mentor female students, "to help generate more enthusiasm." He said, the counselor's role in that would be that of the "matchmaker." Participant 4 said, "I think support would be great. And to be listened to…and encouragement." Participant 5 said he wishes he had "more opportunities." He said having conversations with college personnel is a useful tool. Participant 6 said, "The ability to travel to the schools and see the programs and how they feel" is an effective resource for counselors to learn about specific programs and schools. Participant 7 reiterated, "Yeah, I don't see it as an issue," so did not offer suggestions to change her school's practices.

The researcher noted in her field notes that each participant was interested in helping themselves and others learn and grow.

The Theme of Helping Others

Interview question: If you could help other counselors, what suggestions would you make for working with female students interested in STEM? The researcher asked participants if they could offer other counselors one piece of advice, what would they tell them? The researcher indicated in her field notes that most participants paused before responding to this question. Subthemes emerging from this theme included suggestions, individualized planning, collaboration, and student advocacy.

Participant 1 said, "I would really try to just kind of focus on learning more about the student to find out what they like, what their passions are, and how to help match those for them." This connects to Participant 1's previous statement, saying that the most important responsibility of a school counselor is the relationship. Participant 2 suggested pairing math or science teachers as mentors to students would be useful. She said this collaboration could help support students in those specific areas where counselors may lack knowledge. Participant 3 suggested,

> [Identifying] standout role models who can help change the culture of the school, so that, you know it's okay, it's even cool to do STEM, it's cool to do coding. It's cool to do Calculus, if that's what you're interested in, go for it.

He also suggested collaborating with staff in the building, working with the math, science, and technology departments to develop initiatives and programs to help encourage female students to pursue STEM interests. Participant 4 said she would try to

get to know her students and see how to best help them. Participant 5 suggested that counselors should always offer encouragement to their students. He said,

> Encourage them to have an open slate…not to pigeonhole themselves. Try different things. Try different courses. Don't worry about what other people are doing, as difficult as that is. Think about what you really love and really enjoy. You never know where you're going to find your passion.

Participant 6 said, "Keeping a list with major results would be helpful. And if that was shared among counselors that might be helpful." Participant 7 said, "I think here is almost happens organically, so I don't need to sell them on those programs. So, I don't really know. Our teachers do a really good job."

In her post-interview survey, Participant 6 wrote, "Since we last met, I did reach out to two of my former engineering female students to let them know I'm thinking of them. I'm looking forward to hearing back!" She is aware that her former students can help her work with current students and utilize them as resources for support.

Interview question: Is there anything that you would like to share about your role as a school counselor that I have not asked? Overall, each participant responded in a positive manner when discussing their favorite part of their job. The researcher noted in her field notes that all seven participants sounded happy when responding to this question. They all suggested they are enjoying their careers.

Participant 1 said, "I think it's important to be open-minded and flexible…always try to kind of evolve with your students. I feel like I could always keep learning something new." Participant 1 said while giggling, "Just keep swimming," which references the Disney movie *Finding Nemo* (Stanton & Unkrich, 2003). Participant 2

shared, “[My] favorite part of being a counselor is feeling like you’ve reached the kids…you’ve really helped them.” Participant 3 said, “It’s still a hard job. It’s still a great job. It’s a great job to have where you can make a difference.” Participant 4 focused on the negative perceptions of guidance counselors. She said she does not like the “negative reputations of guidance counselors in movies, in media. Every time this job is depicted, it’s always negative.” She said as she approaches retirement, “I’m really glad.” Participant 5 said, “I just think it’s great that this is on the forefront. Because awareness is the most important thing because nothing changes unless there’s awareness.” Participant 6 said,

> Maybe helping parents and my future self as a parent to recognize that like it’s okay to not know, it’s okay to change your mind. High school is a great opportunity, particularly here, because we offer so many. So please try all different sorts of things.

Participant 7 shared, “I really love my job. It’s just fun and nice to be with the kids. I’m very happy doing it.”

Interview question: If you could change anything in college admissions, what would you change and why? The researcher asked participants if they had a magic wand to wave and improve their school counseling practice, and what they would like to change. The researcher noted in her field notes that participants were all enthusiastic and animated when responding to this question. Participants had various ideas and suggestions. Several participants, including 1, 2, and 5, said they would change more than one thing.

Participant 1 said,

> I would change a lot of things. Many of our really amazing kids suffer. I would say that eliminating ranking, shift it back to more of a fit versus a name. Having the value of what you get from a college education or experience being more important than where you graduated from. Kind of changing the entire realm of thinking because it's just starting to feel so unattainable, And, for many kids, the price is just crazy, and it's tough. There are so many things…changing the admissions process, I guess.

Participant 2 said she would like admissions officers to "be able to meet with students as opposed to read them." She would also like a pre-application to have students see "what they still need to accomplish in high school to become a very strong candidate for admission." Participant 3 said,

> I would make it easier for students to afford college and make it more accessible for students. There's no reason why a school with $1,000,000,000 endowment can't accept more students, and increase their space, and increase their enrollment, but what do I know?

Participant 6 added,

> To make it [college] affordable. Our females are getting scholarships when they study engineering and math. And that's a disparity too. That's not really fair, but I can appreciate they're trying to build females in the STEM programs and make them more affordable.

Participant 4 said she would de-emphasize the SATs and ACTs. She said, "Students are more than just a number. And I think they're more than just a test. I absolutely despise

anything with SATs, and I just don't think one test should be able to make or break a student." She added that she wishes the college admissions representatives could "get to know a student more than just their numbers, because I don't think it's fair." She added, "In the scheme of life, it literally means nothing." Participant 5 said, "The easy answer is to get rid of standardized testing." Participant 5 added, "Get rid of quotas. That's all behind 'closed doors' stuff. But I think getting rid of quotas would be great because I think that also limits kids and maybe females in these fields too." Participant 6 said, "I would change the competitive nature of it. That would be my ultimate dream. That everyone goes to college, and every college is wonderful." Participant 7 said,

> Every deserving kid should be getting into where they want. Wouldn't that be the nicest thing? We have great amazingly qualified kids and sometimes they end up waitlisted in a lot of places or not getting in. And there's absolutely no rhyme or reason that we can tell. And it's based on someone's opinion over someone else's opinion, and that seems really unfair.

The artifacts collected by the researcher included school profiles, photographs of each participant's office, and lists of electives, extracurricular clubs, and activities offered at each school. Content analysis of these documents that emerged in data analysis suggested that these participants share information with their students visually. Therefore, coded themes represented by these photographs include establishing a relationship, sources of support, awareness of students, willingness to learn, and helping others.

Photographs from Participants' Offices

The researcher took photographs of bulletin boards in each participant's office. These bulletin boards display posters, photographs, information, flyers for events,

artwork, and other personal effects. Participant 1's bulletin board contains signs with inspirational phrases, personal photographs, and other personal mementos. Participant 2's bulletin board contains college pennants, SAT registration information, upcoming college events flyers, a summer program flyer, cards from students, a poster from the Gay-Straight Alliance club, and personal photographs. Participant 3's bulletin board displays college posters, a personal photograph, and a poster with inspirational phrases. Participant 4's bulletin board displays flyers for upcoming events, informational flyers, personal photographs, and scholarship information. Participant 5's bulletin board contains college pennants, posters with inspirational phrases, artwork, and personal photographs. Participant 6's bulletin board contains posters with inspirational phrases, college pennants, flyers for upcoming events for students, personal photographs, and other personal mementos. Participant 7's bulletin board contains the school calendar, bell schedule, college pennants, flyers for upcoming events for students, personal photographs, personal mementos, and signs with inspirational phrases.

The analysis of these photographs contributes to the themes (Saldana, 2021) of establishing a relationship, sources of support, awareness of students, willingness to learn, and helping others.

Conclusion

The results of this study indicate that school counselors' perspectives demonstrate that they are interested in helping their female students explore and pursue STEM areas to study in college and beyond. Many participants see a gender gap among their students and are interested in addressing that. All participants expressed an interest in learning more about STEM majors and careers to serve their students better. The processes they

apply when working with students begin with establishing relationships with each of their students. Once they accomplish this, they can differentiate their counseling strategies to meet each individual student's needs. Counselors use career assessment results and discussions, and offer hands-on opportunities, including elective courses and extracurricular clubs and activities, to help their students explore STEM areas and gain knowledge and experience in those areas. These practices can be improved by continuing to learn about changes in those fields and colleges. Previous research illustrates that a gender gap exists in STEM studies and careers, and school counselors can work with their female students to pursue these areas, thus decreasing the gender gap.

The researcher discovered several themes during the interview transcript analysis. Those themes include the importance of establishing a relationship between school counselor and student, sources of professional support received by school counselors, counselor knowledge, career assessments given to students, student strategies to shrink the gender gap in STEM areas, hands-on and academic STEM opportunities available to students, professional development opportunities available, and participants' interests in helping others in the school counseling profession.

Additionally, survey responses, artifacts collected, photographs, and field notes resulted in the emergence of those themes. Responses to the post-interview survey yielded data relating to the themes of sources of professional support received by school counselors, counselor awareness of their students, counselor awareness of their students, and counselor interest in helping others in the school counseling profession. The collection of artifacts and analysis of their content yielded data relating to the themes of the importance of establishing a relationship between school counselor and student,

sources of professional support received by school counselors, hands-on and academic STEM opportunities available to students, professional development opportunities available, and counselor interests in helping others in the school counseling profession.

The analysis of photographs of bulletin boards in each participant's office resulted in the themes of the importance of establishing a relationship between school counselor and student, sources of professional support received by school counselors, counselor awareness of their students, and counselor willingness to learn more. The creation and analysis of the researcher's field notes during and after each interview yielded data that supported the following themes: the importance of establishing a relationship between school counselor and student, counselor awareness of the gender gap in STEM areas, counselors' knowledge of STEM, counselor willingness to learn more, professional development opportunities available, and counselor interests in helping others in the school counseling profession.

The emergence of these themes aligns with Bandura's social cognitive theory (1986), Holland's career theory (1959), and Lorber's gender theory (1994) and where those three theories intersect. Connecting to Bandura's social learning theory, people select specific majors to pursue, colleges to attend, and careers to pursue based on their surroundings and interpretations (1986). Holland's career theory (1959) related directly to this study in that all four of these high schools utilize career assessment tools that incorporate Holland codes directly from this theory. Lorber's gender theory (2010) aims to achieve gender balance, specifically relating to access to career opportunities, which is a goal of the current study.

In conclusion, establishing a relationship between a school counselor and each student is vital for college and career exploration. Upon the formation of that bond, individualized planning can commence.

Chapter 5 presents the implications of these findings, study limitations, and recommendations for future practice and research.

CHAPTER 5

Introduction

In this multi-case study, the researcher aimed to explore how high school counselors influence the choices of STEM majors and careers for female students. The primary purpose of this study was to gather multiple perspectives from high school counselors regarding their work with female students interested in the STEM fields. Other high school counselors can use these perspectives to inform how to best support their female students considering pursuing STEM fields to study in college and as career opportunities. The researcher gathered data utilizing interviews with current high school counselors. The researcher also collected data through field notes, collecting and analyzing artifacts and survey responses. The researcher gathered this information through the lenses of Bandura's social cognitive theory (1986), Holland's career theory (1959), and Lorber's gender theory (1994), and specifically the intersection of these three theories. Data was analyzed using manual coding and MAXQDA software. In this chapter, the researcher discusses the findings as they relate to previously conducted research regarding the critical timing of adolescence, STEM majors, STEM careers, and school counselors' impact on STEM majors and careers.

Participants include seven current high school counselors with between 13 and 24 years of experience working in this profession. Two are males, and five are females. They range in age from 36 to 52. They work in four public schools in an area outside New York City. They each work with students in grades 9 through 12. These schools have between 1,162 and 1,873 students.

Implication of Findings

Overall, the findings of this study suggest that school counselors play a critical role in helping all their students explore college and career options. This study specifically examined counselors' role in helping their female students explore STEM majors. The findings of this study demonstrate that the relationship between the counselor and student is essential to establish and build upon to serve each student individually. Counselors utilized various sources of professional support, including their colleagues, supervisors, building and district administrators, parents, students, and relationships with college admissions personnel.

Counselors are aware of the gender gap in STEM fields and are interested in decreasing that gap. Counselors knew of their students' interests and worked with them to explore college and career opportunities. Counselors were eager to learn more about STEM-specific majors to help their students. Students complete career assessment activities during high school and those results are analyzed with their school counselor to best advise the student on academic and college-related paths. Counselors were eager to decrease the gender gap in STEM fields and offered suggestions on how to do so. High schools offer many academic courses and hands-on activities to students so they can explore various subjects. Appropriate and relevant professional development can allow counselors to continue learning. Counselors gained insight and knowledge by visiting college campuses and learning about majors and opportunities from admissions personnel. Counselors were interested in helping their students, as well as helping other counselors learn and grow within their profession.

Three theoretical frameworks guided this study: Bandura's social cognitive theory (1986), Holland's career theory (1959), and Lorber's gender theory (1994). The intersection of these three theories is the foundation of this study. Each of these frameworks plays a role in understanding the findings of this study.

Research question 1 stated: What are the perspectives of high school counselors on encouraging female students to explore STEM fields to study in college? The results of this study relating to this include the importance of establishing a relationship between school counselors and their students, sources of support, and counselor knowledge.

The finding of establishing a relationship between school counselors and their students is essential. This relates to Bandura's (1986) social cognitive theory. Bandura suggests that people learn their behavior through conditioning or imitating others (Myers & DeWall, 2018). This relationship is the foundation of the school counselor's role. To learn those behaviors, counselors must foster bonds with their students to interact to individualize planning for each student.

The finding of sources of support also connects to Bandura's (1986) social cognitive theory, similar to the previous finding. Bandura suggested that environmental and cognitive factors interact to influence human behavior (McLeod, 2016). Sources of support include professional relationships with others essential to helping counselors to serve their students best.

The finding of counselor knowledge aligns with all three theories: Bandura's social cognitive theory (1986), Holland's career theory (1959), and Lorber's gender theory (1994). Connecting to self-efficacy, included in Bandura's research (Gray, 2011), counselors shared their lack of knowledge related to STEM specifically. All participants

shared ideas on how they can learn more about STEM majors and careers to improve their knowledge and help their students. Participants referred to results of career assessments that relate directly to Holland's career theory (1959). Participants' seeing and addressing a gender gap in STEM majors and careers is related to Lorber's gender theory (1994).

Research question 2 was: What processes do high school counselors apply to these female students, specifically relating to college advising? What are the strengths and weaknesses of these processes? What specific methods can be employed by high school counselors? The results of this study relating to this include career assessments, shrinking the gap, and STEM opportunities available.

The career assessment findings are directly connected to Holland's career theory (1959), and aligned with Bandura's social cognitive theory (1986). Naviance career assessments result in Holland codes, directly linked to Holland's career theory (1959). The basis of these codes is a specific combination of interests, skills, and dispositions. School counselors utilize these assessments so students can discover career paths that align with their personalities (Sheldon et al., 2020). This result also refers to the critical relationship between the counselor and student, which relates to Bandura's (1986) social cognitive theory.

The finding of shrinking the gap aligns with all three theories: Bandura's social cognitive theory (1986), Holland's career theory (1959), and Lorber's gender theory (1994). Connected to self-efficacy, counselors encourage students to pursue their interests. Each school offers a large variety of courses and extracurricular clubs and activities for students to pursue topics of interest (Myers & DeWall, 2018). Again, this

finding is related to Holland codes and students' interests, which is connected to Holland's career theory (1959). Participants desiring to shrink the gender gap in STEM majors and careers is related to Lorber's gender theory (1994). Participants spoke about opportunities offered to all students, not only for females. Lorber suggests degendering, meaning to make gender irrelevant (Lorber, 2000), which was done by these participants.

The finding of STEM opportunities available relates to Bandura's social cognitive theory (1986) and Holland's career theory (1959). The researcher uncovered this finding after document analysis of elective course offerings and extracurricular club and activity opportunities provided by each school participating in this study. Those hands-on experiences connect to Holland's career theory (1959) in providing opportunities to develop interests and talents in specific realms, in this study STEM areas. Relating to Bandura's (1986) theory, people select their environments; in these cases, students select to enroll the specific courses and participate in certain extracurricular activities.

Research question 3 stated: How can these practices be improved so that school counselors can provide better support for their students? The results of this study relating to that include professional development opportunities and helping others.

The finding of professional development opportunities available aligns with Bandura's social cognitive theory (1986). Responses relating to this finding look at training opportunities for participants. These professionals sought more relevant training, offering suggestions on what they would like to learn. Their responses to these specific questions relate to Bandura's social cognitive theory (1986) in that the cognitive part of this theory refers to what people think about a situation affecting their behaviors (Myers & DeWall, 2018). Participants sounded frustrated when discussing the irrelevant

professional development they receive and were eager to share ideas for professional development they would like to receive. Each participant suggested ways for them to learn more, demonstrating their self-efficacy regarding their profession of helping others.

The finding of helping others aligns with Bandura's social cognitive theory (1986) and Holland's career theory (1959). Connecting to Bandura's theory (1986), participants shared suggestions for working with female students interested in STEM. They sounded eager and enthusiastic to help other professionals, which is related to the cognitive part of this theory, referring to what people think about a situation affecting their behaviors (Myers & DeWall, 2018). Aligning with Holland's career theory (1959), many of their suggestions relate to learning more about helping students with specific careers related to their interests (Sheldon et al., 2020). This also relates to the suggestion that for people to feel satisfied, they should choose an occupation compatible with their personality (Curry & Milson, 2017). Participants in this study are all in the counseling profession, which matches their interest in helping others, including their students and other school counselors.

Relationship to Prior Research

Perceptions of school counselors through Social Cognitive, Career and Gender Theory Lenses

Research Question 1 stated: What are the perspectives of high school counselors on encouraging female students to explore STEM fields to study in college?

Theme: Establish Relationship

Establishing relationships is the most salient result of this study. Each participant emphasized that this is the most significant aspect of their job and without this, they are

unable to complete other tasks. The finding of establishing a relationship between the school counselor and each student relates to previous research conducted by Cabell et al. (2021). Those researchers suggested that high school counselors provide interventions and support for their students, relying upon this relationship. They also suggest that school counselors actively support underrepresented students' STEM career interests, again once this relationship is established. Cabell et al. (2021) also found that school counselors do not have enough time to dedicate to discussing STEM career paths with students individually, which connects to the current study's results stating that counselors work with students individually to help them with their academic, college, and career plans. Legewie and DiPrete's (2014) study highlighted the importance of school counselors working with their students individually on career planning. Bystydzienski et al. (2015) found that high school counselors assist their students with financial aid and scholarship opportunities once they are aware of individual student's circumstances, which can be uncovered throughout their time working together. Rainey et al. (2018) looked at relationships with peers or faculty members in their study. They found that those interpersonal relationships are essential when they explored racial and gender differences in how a sense of belonging can influence students' decisions to major in STEM areas. Murcia et al. (2020) found that students appreciate their interactions with career counselors, again emphasizing the importance of this relationship.

Mau and Li (2018) found that high school when high school counselors can implement interventions to assist their students with future career aspirations through this relationship. Reinking and Martin (2018) emphasized that educators' influence on their students to have a life-long impact on their futures. Mohtar et al. (2019) suggested that

educators play significant roles in supporting their students and their interest in STEM careers. They also pointed out that students look to their school counselors for academic, career and college advice and support, and that counselors play a critical role in helping their students, emphasizing this relationship. Sherman-Morris et al. (2019) addressed the importance of school counselors working with underrepresented students in their college searches, drawing upon their already-established relationship. Brookover (2021) explored the long-term impacts of school counseling access, which implies that this connection will also be crucial in the future.

Theme: Sources of Support

The findings also show that participants have and utilize various sources of professional support. Cabell et al. (2021) found that school administrators support school counselors' STEM initiatives. Sherman-Morris et al. (2019) found that parental support and involvement play a role in school counselors' ability to influence students' college and career planning. They further explained the importance of parental involvement and teachers as influential individuals in students' career exploration processes, collaborating with school counselors to best serve each student (2019). Sherman-Morris et al. (2019) said that students of lower socioeconomic status have fewer resources, including campus visits and access to admissions officers. Participants in this study shared that relationships with college admissions personnel are a vital source of support for them, which can alleviate that issue.

Theme: Counselor Knowledge

The researcher broke down the finding of counselor knowledge into three parts. The first is counselor knowledge of STEM, the second is counselor's knowledge of their students, and the third is counselors' willingness to learn.

Regarding counselor knowledge of STEM, the results Cabell et al.'s (2021) study included professional knowledge surrounding issues of diversity in STEM. Murcia et al. (2020) looked to determine how career counselors' awareness and engagement with STEM majors can impact students' career interests, connecting to the result that a counselor's knowledge of STEM is pivotal in helping their students. Sherman-Morris et al. (2019) explored school counselors' knowledge and beliefs about geosciences and which activities they use in career counseling. This study directly connects to the finding of counselor knowledge of STEM. Brookover (2021) suggested that school counselors play integral roles in helping their students prepare for college by providing college-readiness counseling, focusing on STEM possibilities. She further explained the importance of high school counselors providing information and support for college access and success. This connects to the current study's finding of knowledge of STEM in that counselors must have this knowledge to support their students appropriately.

Regarding counselors' knowledge of their students, Davison et al. (2014) found that school counselors working with students of varied abilities need to look beyond math and science abilities. Their finding aligns with the findings in this study, suggesting that school counselors need to have knowledge of their students to help them with career planning. Murcia et al. (2020) explored specific aspects of career planning that school counselors perform, including course selection, promotion of academic rigor, strategic

direction, and attention to under-represented groups. The researcher discussed these aspects during participants' interviews regarding matching student interests with STEM-related opportunities, connecting to the finding of the importance of counselor knowledge of their students.

Regarding counselor knowledge of counselors' willingness to learn, Murcia et al. (2020) found that counselors aim to support their students in all interests and are eager to learn more about specific STEM changes and opportunities for their students, aligning with this finding in the current study.

Processes school counselors apply through Social Cognitive, Career, and Gender Theory Lenses

Research Question 2 stated: What processes do high school counselors apply to these female students, specifically relating to college advising? What are the strengths and weaknesses of these processes? What specific methods can be employed by high school counselors?

Theme: Career Assessment

Regarding the theme of career assessment uncovered in this current study, Cabell et al. (2021) suggested that career development assessments are vital for counselors to support their students. In the current study, all participants addressed that in their interview responses. Each talked about career assessments their students take and how they use those results to assist students in their career planning.

Theme: Shrinking the Gap

Participants of this study were all interested in shrinking the gender gap in STEM majors and careers. Cabell et al. (2021) found that the gender gap in advanced STEM

courses results in a gap in skills and a lack of further interest in STEM careers, relating to this finding in the current study. Legewie and DiPrete (2014) found that the context of high schools can decrease the gender gap, meaning that supporting females interested in STEM, providing strong curriculum in math and science, and offering extracurricular activities in STEM areas all can decrease the gender gap in STEM areas, relating to this finding. Legewie and DiPrete (2014) also found that hands-on opportunities offered to high school students can address this gender gap, similar to the data in the current study. Rainey et al. (2018) explored the existence of a gender gap in STEM majors relating to this finding. Mother et al. (2019) found that high school counselors in their study contribute to the STEM gender gap and suggested that the advice female counselors give their students differs based on the student's gender. Martinez et al. (2021) suggested that to shrink the gender gap, school counselors should advocate for increased student participation in hands-on STEM activities. Reinking and Martin (2018) found it is critical to encourage all students to pursue STEM interests, connecting to the finding of striking this gender gap. Nikischer et al. (2016) explored the significant role of the high school counselors in their students' postsecondary choices. They suggested that counselors can improve math and science outcomes and increase pathways to STEM careers, connecting to the findings of the current study. Mann and DiPrete (2013) found that females are less likely than males to select STEM majors and suggested a way to shrink this gender gap, including the need for social policies.

Theme: STEM Opportunities Available

Elective Courses

Providing real-life, hands-on opportunities to expose students to STEM fields is a vital aspect of career exploration, as it is a result of the current study. One of those hands-on opportunities includes high school courses, examined in the current study. Cabell et al. (2021) suggested that schools provide high school students with higher-level STEM coursework options. This study looked closely at course offerings as ways for students to gain STEM knowledge and appreciation. Legewie and DiPrete (2014) studied the strength of high schools' math and science programs and how that may impact students' STEM interests. Bystydzienski et al. (2015) looked at students' grades in math and science courses specifically as an aspect of addressing the gender gap in STEM majors. Tam et al. (2020) highlighted the significance and need for a solid STEM education to nurture and develop talents for STEM career paths. They found that STEM education can effectively empower girls, contribute to the ICT industry, and connect to this finding. Davison et al. (2014) examined the impact courses taken during high school can have on the choice of STEM majors in college, showing the connection to the current study. Murcia et al. (2020) suggested that STEM opportunities should be offered to all children, starting at young ages, again connecting to the result in this study. Reinking and Martin (2018) found that hands-on learning can play a role in students' interests, connecting to the current study's result. Nikischer et al. (2016) suggested that schools should offer high-level math and science courses and encourage students to enroll in the highest-level courses they can complete successfully, connecting to the results in the current study.

Hands-On Activities. Regarding other hands-on opportunities, during Bystydzienski et al.'s study (2015), students were offered hands-on opportunities, including club meetings, career fairs, meeting practicing engineers, and visiting engineering schools and workplaces. All of those experiences were described enthusiastically by the students. Those experiences align with the result of STEM opportunities available in this study. Tam et al. (2020) researched a STEM extracurricular activity offered to female secondary school students. They found that STEM education can effectively empower girls, contributing to the equality in the ICT industry. That study connects to this finding. Nikischer et al. (2016) addressed the importance of extracurricular activities specifically to engage female students, relating to the result of this study.

Improving Practices through Social Cognitive, Career, and Gender Theory Lenses

Research question 3 stated: How can these practices be improved so that school counselors can provide better support for their students?

Theme: Professional Development Opportunities

In this study, counselors feel they do not receive appropriate ongoing training. School counselors need to receive relevant and continuous professional development and training during their counseling graduate training programs and throughout their careers, to work effectively with their students on career exploration and college planning. School counselors must continue to learn and grow (Harmon et al., 2021) to best help their students currently and in the future. Each participant stated that they want to continue learning, especially related STEM areas.

All participants said the professional development they receive from their schools and districts is geared toward teachers and is not valuable for them. The participants offered alternative options to inform themselves of the changing landscape of STEM fields. All participants admitted that they do not know "a lot" and "enough" about STEM, yet they all want to learn more and offered suggestions for acquiring this knowledge. Cabell et al. (2021) recommended that school counselors receive training related to the needs of underrepresented students in STEM, looking at gender as an underrepresented group in the current study. Cabell et al. (2021) found that schools lack this training. This finding relates to the current study in that participants also shared that issue.

Murcia et al. (2020) suggested that school counselors need to learn more about modern career opportunities, specifically related to STEM fields, and emphasized the need for professional development. Mohtar et al. (2019) suggested that high school counselors should be provided with training programs and workshops to investigate any gender biases they might have that might impact how they advise students on STEM areas. Nikischer et al. (2016) found school counselors must receive updated professional development opportunities to stay current with the rapidly changing STEM fields. Nikischer et al. (2016) said school counselors need to continue to learn throughout their careers, directly connected to the results of this study in that all participants agreed with that and were eager to do so. Sherman-Morris et al. (2019) also said school counselors demonstrated a lack of knowledge and should be exposed to different science fields to better support their students. Welsch and Winden (2019) recommended creating training programs and workshops to investigate any biases school counselors may have about gender and careers.

Theme: Helping Others

A result of this study, *helping others*, demonstrates that participants want to help their students and their colleagues. They each offered ideas on how to do so. Bystydzienski et al. (2015) suggested a need for social policies to look at and address the gender gap in STEM majors. Mau and Li (2018) recommended collaboration with other professionals to decrease barriers to students' academic success. Mau and Li (2018) said that working with others should promote academic achievement, self-efficacy and identity, and self-advocacy for female and minority students. Martinez et al. (2021) stated a need for data-based research to demonstrate how school counselors' advocacy is conceptualized in the profession.

Limitations of the Study

This study has two limitations. Since the researcher included only high school counselors as participants, there is a chance of sample bias. Reflections of middle and elementary school counselors can yield different perspectives since they work with students of other ages.

The researcher works in the school district where two of high schools in the study are located. This familiarity may lead to respondent bias. Selecting participants who do not know the researcher may allow them to reflect more openly in their responses.

Regardless of these limitations, this study can enhance previous research on school counselors' perspectives on encouraging their students to pursue their interests in all areas.

Recommendations for Future Practice

School counselors can use the findings from this study to improve practices for working with female students on career exploration and college planning. As Participant 5 suggested, graduate programs should offer more practical experiences, as opposed to theoretical concepts, in training the next generation of school counselors.

School administrators should allow school counselors to be integral in selecting relevant and appropriate professional development opportunities for themselves. School counselors should be able to attend workshops geared to their professional needs, not necessarily for classroom teachers. Counselors should be provided with support and encouragement to pursue ongoing training. Based on the results of this study, that support should include time and financial support allocated to visiting college campuses. Counseling departments should cultivate relationships with college personnel to receive updated information on their programs and opportunities for students. Administrators can capitalize on the eagerness of counselors to engage in ongoing training. They can allow counselors to design their own professional development. They should encourage their counseling staff to want to continue learning.

Recommendations for Future Research

Future researchers can build upon the findings of this study in several ways. First, researchers can extend the findings to school counselors from the middle and elementary levels and garner their perspectives on these topics. Researchers can also speak with school counselors in other areas of the country to acquire their perspectives. They can also speak with the participants of this study again in several years to see if they have received any additional training and if their perspectives on this topic have changed.

Researchers can also speak with students and alumnae to garner their perspectives on this topic. These participating schools were all in suburban areas. Future research can expand to look at urban and rural locations. In this study, 12-34% of students are eligible for free/reduced lunch, indicating that the majority of these students do not suffer from tremendous financial need. Other researchers can look at locations with greater financial need to assess those counselors' perspectives on this topic.

Conclusion

CACREP's standards for school counselors focus on best practices for college and career advising. Their contextual dimensions include the school counselors' roles about college and career readiness, their use of developmentally appropriate career counseling interventions and assessments, strategies to facilitate school and postsecondary transitions, and interventions to promote college and career readiness (CACREP, 2022). The results of this study demonstrate that these seven participants meet and exceed CACREP's standards relating to best practices for college and career advising. "School counselors play a vital role in supporting the academic and career success of all students" (Cabell et al., 2021, p. 30).

This study explored how high school counselors influence the choices of STEM majors for female students. The researcher examined perspectives of school counselors who work with female students interested in the STEM fields. The findings of this study can inform other high school counselors on how to best support their female students choosing to pursue STEM fields to study in college and as career opportunities. This study built upon previous research that looked at the role of school counselor in college and career advising and counselors' knowledge of STEM-related programs. Counselors'

perspectives highlighted the importance of the relationship they build with their students. For counselors to perform all other tasks, they must first establish relationships with students so they can address their individual needs. Moving forward, school leaders should allow school counselors to take active roles in selecting relevant and appropriate professional development opportunities for themselves, based on their needs. Counselors should be encouraged to continue learning to keep up to date on changes and opportunities to best serve their students. School districts should offer hands-on activities for students to pursue STEM interests, including elective courses and extracurricular clubs and activities. Graduate schools should incorporate more practical training and focus less on theoretical approaches to school counseling. The perspectives shared in this study can be instrumental in shrinking the gender gap in STEM majors and careers.

APPENDIX A IRB APPROVAL

Federal Wide Assurance: FWA00009066

Jun 5, 2023 12:28:08 PM EDT

PI: Carly Bank
CO-PI: Barbara Cozza
The School of Education, Ed Admin & Instruc Leadership

Re: Expedited Review - Initial - IRB-FY2023-342 Girl Power: How Can School Counselors Empower Female Students To Study STEM Related Majors In College And Beyond?

Dear Carly Bank:

The St John's University Institutional Review Board has rendered the decision below for Girl Power: How Can School Counselors Empower Female Students To Study STEM Related Majors In College And Beyond?. The approval is effective from June 5, 2023 through June 3, 2024.

Decision: Approved

PLEASE NOTE: If you have collected any data prior to this approval date, the data must be discarded.

Selected Category:

Sincerely,

Raymond DiGiuseppe, PhD, ABPP
Chair, Institutional Review Board
Professor of Psychology

APPENDIX B LETTER OF CONSENT

ST. JOHN'S
UNIVERSITY
THE SCHOOL OF EDUCATION

My name is Carly Bank and I am a doctoral candidate in the Department of Administrative and Instructional Leadership at the Graduate School of Education, St. John's University, Queens, NY. I am conducting a study for my dissertation titled: *Girl Power: How can school counselors empower female students to study STEM related majors in college and beyond*? My mentor is Dr. Barbara Cozza, Department of Administrative and Instructional Leadership, St. John's University.

Purpose of the Study: I am writing to obtain your consent to allow high school counselors in your district to participate in a research study being conducted for a dissertation for St. John's University. The purpose of this multi-case study is to explore how high school counselors influence the choices of STEM (Science, Technology, Engineering and Math) majors for female students. This study will gather multiple perspectives from high school counselors regarding their work with female students interested in the STEM fields. Their perspectives can be used to inform other high school counselors on how to best support their female students considering pursuing STEM fields to study in college and as career opportunities. Aspects of the study include demographic surveys, counselor interviews with me (the researcher), observations, counselor surveys, and collections of artifacts within the counseling offices (including list of electives offered with descriptions, course catalog, Naviance information, career planning resources).

Voluntary Participation: Participating in this study is voluntary. Counselors may refuse to participate, choose not to answer specific questions in the interview process, or withdraw at any time without consequence.

Confidentiality: Pseudonyms will be assigned to each counselor, school and district to maintain anonymity. Counselors will be asked to provide their age, gender, identity, job title, education level, years in current school, years in profession and number of students on their caseload in the demographic survey. I will preserve all confidentiality throughout the study by coding any identifying data such as counselor and school names. If counselors wish, at any point, they can contact me directly at carly.bank06@my.stjohns.edu.The data collected will only be viewed by the individual participants and me. The counselor can review any data sources throughout the study to ensure that all viewpoints are accurately portrayed. All collected data will be destroyed at the end of the legally prescribed time frame, which is three years.

Possible Risks and Benefits: There are no known risks associated with their participation in this research beyond those of daily life. Although they will not receive any remuneration or direct benefit, the results of this study may help school counselors working with female students interested in pursuing STEM fields.

Contact Information: If you have any questions or concerns, about my study or your participation, or if you wish to report a research-related problem, you may contact me, Carly Bank at carly.bank06@my.stjohns.edu, or my mentor, Dr. Barbara Cozza at cozzab@stjohns.edu. You may also contact the Coordinator of the Institutional Review Board at St. John's University, Dr. Raymond DiGiuseppe at (718) 990-1955 or at digiuser@stjohns.edu.

Participation: Your support providing consent for your district to participate in the study would be greatly appreciated to further understand the experiences of high school counselors regarding their work with female students interested in the STEM fields. As fellow educators, our efforts through research can be shared to identify best practices for high school counselors working with students on college and career planning. The interviews should only take 30-40 minutes to conduct. The surveys are brief and should take approximately 5-10 minutes to complete. Included in this packet is a copy of the interview protocol and counselor letter of consent.

Thank you in advance for your consideration for allowing your school district to participate in this study on the gender gap in STEM areas.

Sincerely,

Carly Bank
Doctoral Candidate,
carly.bank06@my.stjohns.edu
Department of Administrative and Instructional Leadership
St. John's University
Queens, NY 11439

Signatures

I have read the above description of the proposed study by Carly Bank and understand the conditions of the participation of the district and high schools. I understand the data from the demographic surveys will be anonymous. I understand the data collected from the interviews, observations, and collected artifacts will be coded and will not be used in any way to identify the school district, the school, or the counselors. I understand that confidentiality and anonymity are absolute. My signature indicates that I agree to allow the district (high school counselors) to participate in this study.

Superintendent's Signature: _____Date: _____

Superintendent's Name:

Researcher's Signature: _____Date: _____

Researcher's Name: Carly Bank

APPENDIX C RECRUITMENT EMAIL TO COUNSELORS

Good morning. I am a graduate student at St. John's University and I would love for 2 high school counselors to participate in my dissertation research, which is looking at the gender gap among students pursuing STEM fields and how high school counselors can help shrink that gap. I would ask to meet with them in-person, or virtually (whichever they prefer) for approximately 30 minutes at the beginning of June.

If you have any further questions, please reply to this email. I look forward to working with you on this project and I am so grateful for your time.

Thank you again,

Carly Bank

APPENDIX D EMAIL REQUESTING DEMOGRAPHIC INFORMATION

Thank you for participating in this study. Please fill out each item below and return it to carly.bank06@my.stjohns.edu. Your name, school name and school district name are not included in this study. You will be assigned a pseudonym to protect your anonymity and confidentiality. I am the only person who will have access to your responses. Thank you again!

Age _____
Gender _____
Ethnicity _____
Job Title _____
Education Level _____
Years in Current School _____
Years in Profession _____
Number of Students on your Caseload _____

APPENDIX E INTERVIEW PROTOCOL

Describe what you believe to be the most important responsibilities of a high school counselor.

What professional development opportunities have you received during your tenure?

What additional training do you wish you had?

What sources of support do you have?

This study is looking at the gender gap in STEM majors and careers. Do you see this as an issue?

Do you help match your students with specific majors?

What about STEM specifically?

Do you or does your school currently do anything to increase females pursuing STEM majors?

What STEM-specific college and/or career knowledge do you have?

What additional training and/or support would help you in this area?

How do you know if students are interested in STEM areas?

Do you see a gender gap in these areas? If so, how can that be fixed?

What tools do you wish you and/or other counselors had?

What real-life STEM opportunities are available to your students?

How familiar are you with STEM majors and careers? How could you learn more about those? Do you know the different types of engineering disciplines and pathways? How could you learn more about those?

If you could change anything in college admissions, what would you change and why?

Is there anything that you would like to share about your role as a school counselor that I haven't asked?

APPENDIX F SURVEY PROTOCOL

Since we last met, is there anything you would like to discuss?

Has your practice changed since we met?

Are there any other points you would like to bring up?

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