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Experiences of African American Students in a STEM-Focused Community Program

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This is to certify that the doctoral dissertation by

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has been found to be complete and satisfactory in all respects,
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Abstract

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Dissertation Submitted in Partial Fulfillment

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Abstract

The United States has invested millions of dollars in STEM program initiatives; however, African Americans in STEM career fields are underrepresented. The purpose of this qualitative hermeneutic phenomenological study aimed to explore the lived experiences of African-American first-year college students from rural communities in a STEM program and whether their experiences influenced their decision to pursue a STEM major in college. Spencer's phenomenological variant of ecological systems theory (PVEST) was used to frame the study. Data were collected from semistructured interviews with eight African American first-year college students from rural communities. Coding analysis involved identifying meaning units and situated narratives to identify seven themes: experiential learning projects, sources of support, early exposure, networking opportunities, lack of diversity, self-perception, and disconnect between college expectations and student preparedness. Findings revealed that although students found STEM programs valuable and engaging, they lacked information about college expectations and diversity. PVEST highlighted the importance of understanding people's processes when they perceive the world. This study provides implications for stakeholders to consider the experiences of African American students when designing pipeline STEM programs that address the underrepresentation of African Americans in STEM career fields.

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Dedication

I dedicate this work unto the Lord. Without God, I would not have completed my dissertation, considering the number of hurdles I experienced. Throughout this journey, I have been reminded of John 15:5: I am the vine: you are the branches. If you remain in me and I in you, you will bear much fruit; apart from me, you can do nothing. Every time I became discouraged during this journey, I was reminded to lean on God and the genuine help of others.

I'm also dedicating this study to every little boy and girl who grew up in communities where deficits, environmental risks, and destructive pathways are highlighted, often leading to assumptions and negative trajectories. Don't give up on your hopes and dreams. Keep pushing forward. You are destined to do great things.

I am dedicating this to myself. Why? Because I was once that girl who didn't think she could, but she did!

Last, I dedicate this study to the African American STEM scholars I mentored while working in higher education. Thank you all for trusting me to be your protective factor.

Acknowledgments

I give glory, honor, and thanks to God, who was with me every step of the way.

I want to thank my husband for supporting me, often sacrificing his needs to ensure I focused on completing my work. The time he took to send me articles to read. That time when he explained my study better than I did. We worked and sacrificed many things to get here. This is our degree.

I want to thank my mom for her selfless work in the community. Growing up, my mom taught me the importance of community programs and serving as a positive role model. My mom worked hard and did many great things for the children growing up in the inner city. My mother's influence inspired many young people to excel despite their environments, limited resources, and circumstances.

I thank my dog, Champ. I have pictures of Champ falling asleep near my feet as he waited patiently for me to complete a chapter so I could play with him. He licked tears from my face when I was stressed out because of writer's block. I love my dog! I thank my sister, friends, and family for all the encouraging messages they sent that helped me to finish. They have supported me despite my being busy.

Last, and more importantly, I want to thank my committee: Dr. Tracy Jackson, who served as my chair, and second committee member, Dr. Jeffery Harlow. Dr. Jackson's text messages, discussion board posts, and encouragement have been pivotal to my academic success. She pushed me during moments when I became discouraged. She is an inspiration to me and so many other students. Dr. Harlow used what he referred to

as the “nudge theory” to push me to dig into my study beyond surface-level thinking. I am grateful for his helping me to recognize my potential.

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Chapter 1: Introduction to the Study

The increased demand for individuals with expertise in science, technology, engineering, and mathematics (STEM) calls for U.S. educational institutions to teach and train the best and brightest to meet the nation's needs (Kennedy et al., 2017). The number of highly qualified STEM professionals does not meet the current national needs (Diekman & Benson-Greenwald, 2018). There continues to be substantial evidence that STEM-focused degree programs and career fields are underrepresented by African American students (Finkel, 2017). More specifically, the underrepresentation of African American youths from rural communities in STEM-focused degree programs and occupations has created a need for more community-based programs for students from these populations (Ihrig et al., 2018; Showalter et al., 2019).

In Chapter 1, I present background information about the challenges public schools face in rural communities. I also highlight the underrepresentation of African Americans in STEM-focused careers, which segues into the identified research problem. This study's purpose highlights the significance of capturing the lived experiences of African American students who have participated in a STEM program. Also included in this chapter are the philosophical approach, theoretical framework, and the nature of the study. Finally, Chapter 1 includes definitions, assumptions, scope and delimitation, limitations, significance, and a summary.

Background

Researchers suggested that youths who live in rural communities need access to STEM-focused community programs compared to youths who do not live in these areas

(Harris & Hodges, 2018). The underrepresentation of African Americans in STEM-focused degree programs and occupations has created a need for more community-based programs that serve African American students who live in rural communities (Sheffield et al., 2018). According to a biennial report by the Rural School and Community Trust, a national nonprofit organization that analyzes the conditions of rural education in the United States, nearly 7.5 million students in public schools are enrolled in rural school districts (Showalter et al., 2019). The report also indicated that almost 1 in 6 students are below the poverty line (Showalter et al., 2019).

Although greater attention has been placed on the educational needs of students living in rural communities following the 2016 presidential election, there continue to be challenges that demand the nation's efforts and attention (Showalter et al., 2019). Researchers have found that the overall academic performance of students living in rural communities is considerably lower than those who live in suburban and urban areas (Rivera et al., 2019). Assouline et al. (2017) found that despite students identified as high achieving, those who live in rural communities lack access to high-quality STEM opportunities. Additionally, researchers found that college recruitment officers seek to recruit students in affluent, urban, and suburban communities at a higher rate than those living in rural communities, resulting in their low matriculation rate in colleges and universities (Ontiveros, 2020).

For several reasons, rural schools need help implementing STEM-focused programs (Weiss, 2019). Socioeconomics, specifically financial capabilities and educational attainment, lack of funding resources, and shortage of qualified and skilled teachers are among the many challenges that public schools in rural communities face when seeking to teach and train young people STEM subjects (Rivera et al., 2019). Teachers with extensive STEM backgrounds are usually attracted to schools with more state-of-the-art resources and higher pay (Brownell et al., 2018). This leads to high turnover rates and teachers with a general background in STEM because of the limited funds needed for professional development and support services (Rivera et al., 2019).

In Florida, more than 150,000 students attend public schools in rural communities (Showalter et al., 2019). Nearly 1 in 5 students living in rural communities are below the poverty line, and African Americans are disproportionately represented (Showalter et al., 2019). Researchers have also found that teachers in rural communities are paid significantly lower salaries than teachers in other localities, and instructional resources are scarce for each student (Dos Santos, 2019; Ulferts, 2018). Although it has been shown that high school students living in rural areas in Florida achieve advanced placement credits at higher rates than in other states, many students do not take advantage of opportunities to complete dual enrollment at local community colleges and universities (Ohlson et al., 2018).

Problem Statement

The research problem in this study was the low college matriculation rates of African American students in STEM-focused majors. To address the national concern, former President Obama's administration, policymakers, and science and technology industry leaders have encouraged communities to create opportunities that expose young people to STEM-focused programs due to the growing demand for these fields

(Doerschuk et al. 2016). Despite the increase in community programs, researchers have found that STEM-focused programs are less likely to be located in rural communities than in nonrural communities (Bottia et al., 2017). African American students from rural communities continue to be underrepresented in STEM-related majors and careers due to the lack of understanding of their experiences in STEM programs (Stipanovic & Woo, 2017; Trawick et al., 2020).

Much of the research about African American youths and their interest in a STEM major has focused on the factors that influence students' aspirations in STEM careers and the barriers that prevent their academic achievement and success in STEM majors (Mau & Li, 2018; Miller et al., 2017). Literature that provides the experiences of students from rural communities participating in STEM programs can guide program developers in determining specific program features that influence matriculation into STEM majors (Beckett et al., 2019). Informed by this research, many states can allocate funds to create more community-based STEM programs focusing on rural communities (Wade-Jaimes et al., 2019).

Although the research regarding the underrepresentation of African American youths in STEM illuminated essential findings, I found limited research on the lived experiences of African American first-year college students from rural communities who have participated in STEM programs. Further research was warranted that could reveal the experiences of African American first-year college students who participated in STEM community programs to address the documented problem of low matriculation rates of African American students in STEM college majors (Hudacs, 2020; Weeden et al., 2020).

Purpose of the Study

The purpose of this hermeneutic phenomenological study was to explore the lived experiences of African American first-year college students from rural communities in a STEM program and whether their experiences influenced their decision to pursue a STEM major in college. Previous studies found that students in rural communities are underrepresented in science at all levels and tend to shift away from STEM in high school (Barshay, 2021; O'Neal & Perkins, 2021; Tran et al., 2021). The current study emphasized the importance of understanding how students from rural communities experienced STEM programs before college. The central aim of hermeneutic phenomenology is for the researcher to understand other people's lived experiences and how they make sense of and ascribe meaning to these experiences (Heidegger, 1982). The phenomenological variant of ecological systems theory (PVEST) proposes that individuals understand, interpret, and make meaning of their everyday experiences (Spencer, 2006). Data analyzed through this lens may provide researchers with insights into ethnic minorities and racial groups situated in reality constructed by subjective experiences. As a result of the current study, state and local community program developers may understand how students from rural communities experience STEM programs, highlighting the importance of early exposure to STEM programs, experiential learning opportunities, and support sources.

Research Questions

The following research questions were addressed in the study:

RQ1: What are the lived experiences of African American first-year college students from a rural community in a STEM-focused program?

RQ2: How did the experiences influence their decision to pursue a STEM major in college?

Philosophical Approach

I used a hermeneutic phenomenological approach and a PVEST lens to understand students' lived experiences in a STEM program. Hermeneutic phenomenology, proposed by Heidegger 1982, as cited in Wilson & Hutchinson, 1991), focuses on illuminating specific details about lived experiences to create meaning and new understandings. This framework emphasizes interpretation as a way to enhance the meaning of the daily experiences of research participants (Peoples, 2020). Developed by Spencer (2006), PVEST is a framework used to examine resiliency, identity, and competency formation among diverse youths. The theory is an identity-focused cultural, ecological perspective that can be useful in describing normative developmental processes for minority youths. (Spencer et al., 1997; Spencer, 2006). This approach examines how individuals understand and view the world around them. PVEST addresses the relationship between an individual's view of the world and the impact of sociocultural and historical forces that influence the individual's development. The system's framework posits that beliefs mitigate various aspects of people's lives, so what may be perceived as a negative factor in an individual's life can be counterbalanced by positive support systems or views (Spencer, 1997). Under supportive conditions and resources, individuals' interests can be nurtured and fulfilled. PVEST is used to answer "how" and "why" questions rather than simply the "what" (Spencer et al., 1997).

Nature of the Study

A hermeneutic phenomenological approach was chosen as the most appropriate method for this study to develop a deeper understanding of African American first-year college students' experiences from rural communities in a STEM-focused program. Hermeneutic phenomenology involves using data to emphasize the numerous meanings within a phenomenon and draws the researcher into new considerations and understandings (Crowther et al., 2016). I used the hermeneutic phenomenological approach to understand first-year African American college students' lived experiences and understand the factors that informed the students' decision to pursue a STEM major.

To use a phenomenological approach, researchers must recognize the philosophical principles that serve as a framework to theorize the meaning of human experiences (Benner, 1994; Peoples, 2020). Peoples (2020) suggested that choosing a phenomenological research methodology requires scholars to reflect and become familiar with approaches used to study human experiences. There are different philosophies that scholars can embrace; however, two broad philosophical traditions are identified as the descriptive (transcendental) and hermeneutic (interpretive), developed by Husserl and Heidegger, respectively (Austgard, 2012; Creswell, 1998). I used a hermeneutic approach as the foundational framework to understand students' lived experiences in a STEM program. Additionally, when used as a methodological approach, hermeneutics complemented PVEST. Both frameworks emphasized the importance of cultural contexts to understand the lived experiences of African American students in a STEM program.

I conducted semistructured interviews via Zoom to collect the participants' responses for this study. The homogenous purposive sampling method was used to select participants in the hermeneutical phenomenological study because of their shared lived experience of the phenomenon (see Laverty, 2003). The participants chosen for the current study were African American first-year college students from rural communities who participated in a STEM program. I recruited participants by posting flyers in public areas and sending invitations through social media platforms.

Definitions

Community based: A philosophical approach in which communities work together to develop and implement programs to address the community's needs (Van Bibber, 1997).

Dasein: A term coined by Heidegger 1982, as cited in Kockelmans, 1973, p. 60) that means "being there."

First-year college student: A student in their first year at an educational institution, usually at a secondary or postsecondary school (State University System of Florida, 2019, p. 1). For the current study, a first-year college student was classified as having 0–29 credit hours (see State University System of, 2019, p. 1).

Hermeneutics phenomenology: Hermeneutic phenomenology focuses on the subjective experiences of individuals as lived through their life world (Heidegger, 1982).

Phenomenological variant of ecological systems (PVEST): A framework that emphasizes and integrates individuals' intersubjective experiences with Bronfenbrenner's ecological systems theory (Spencer, 2006).

Phenomenology: An approach used to describe the essence of a phenomenon by exploring it from the perspective of those who have experienced it (Moustakas, 1994).

STEM: An acronym for science, technology, engineering, and mathematics (Barkatsas et al., 2019).

STEM education: An interdisciplinary approach to learning that includes academic concepts from science, technology, engineering, and mathematics (National Science Teaching Association, 2018, p. 1).

STEM program: A series of planned activities involving learning activities integrating science, technology, engineering, and mathematics (Dicht et al., 2022).

Rural community: Rural community is "any population, housing or territory that is not an urban area" (U.S. Census Bureau, 2020, p. 1).

Transcendental phenomenology: Transcendental phenomenology focuses on capturing descriptions of participant experiences that highlight the essence of a phenomenon (Husserl, 1970).

Assumptions

Several assumptions were identified in this study. Peoples (2020) suggested that there is an understanding in a hermeneutic phenomenological study that biases cannot be set aside or bracketed. Therefore, the researcher must recognize their assumptions and biases, referred to as fore-conceptions, and revise their understanding as new information is uncovered (Gadamer, 2004; Peoples, 2020). The first assumption was that I would identify students from rural communities who participated in STEM programs before college. The next assumption was that students selected for interviews would be engaged, open, and comfortable sharing their experiences. The third assumption was that the students would have basic knowledge of STEM careers and college majors. Several studies supported STEM programs as increasing high school students' likelihood of studying STEM in college (Havice et al., 2018; Hughes et al., 2021; Zhou et al., 2017). The fourth assumption was that participation in STEM programs influenced students' decisions to pursue a STEM major. Given the abundance of research that indicated the effectiveness of STEM precollegiate programs, I assumed that students had a positive experience, especially if the program was engaging and related to their field of interest. Lastly, I assumed that participants would believe that the scarcity of resources in their community was a barrier to pursuing a STEM degree in college.

Scope and Delimitations

This study addressed the need for more research regarding the lived experiences of African American first-year college students from a rural community who had participated in a STEM-focused community program and how the experiences influenced their decision to pursue a STEM major in college. Many quantitative studies focused on persistence and motivating factors influencing students' decision to pursue STEM in college (Covault et al., 2017; Sepanik et al., 2018; Utley et al., 2019). To fill the literature gap, I focused on the lived experiences of African American first-year college students from rural communities majoring in STEM. A homogeneous purposive sampling method was used to recruit participants, allowing me to select individuals with shared characteristics relevant to the study. Two complementary frameworks were adopted to explore the participants' experiences in a STEM program before going to college. A hermeneutic phenomenological methodological design and PVEST lens were applied to understand the participants' experiences, including the experiences that influenced their decision to pursue a STEM major in college. Explicit processes and procedures of this study were explained, providing future researchers with the process and tools needed to design a similar hermeneutic study (see Willing, 2007). This explanation included the procedures used for selecting participants, the research contexts, and collecting and analyzing the data to promote consistency (see Paterson & Higgs, 2005).

Limitations

My research was subject to limitations. My primary data source was the interviews conducted with African American first-year college students from rural communities. Repeating this study might pose challenges for future researchers. For example, because I interviewed first-year college students from rural communities, some aspects of the original study cannot be repeated. Bonett (2021) asserted that this makes it hard to confirm or deny the original study results. Students and community resources may change, among several other evolving factors. Future researchers can distinguish between repeatable practices and nonrepeatable results (Talkad & Metoyer, 2019). In hermeneutics, the researchers determine the most appropriate method based on the study and the research participants (Willing, 2007). Bernstein (1983) posited that hermeneutic researchers enter a study with unique understandings and inspirations to explore and discover a phenomenon. A strong interest in understanding students inspired this study of lived experiences in a STEM program. My passion for higher education could have hindered my study, specifically my interest in creating spaces for African American students to succeed in their academic goals.

Qualitative research requires enough time to capture data from participants. The amount of time it takes to go through the process of a qualitative study, particularly one using a phenomenological approach, is significant. Creswell (2007) highlighted that qualitative research could take more time than quantitative data because responses gathered during interviews are descriptive rather than numerical. The data collection in the current study was time-consuming because most time was spent identifying the participants who fit the inclusion criteria and coordinating appointment dates that worked with respondents' schedules. The process took several months, not including the labor-intensive data analysis (see Elo et al., 2014).

Phenomenological studies require researchers to understand phenomena within participants' experiences, views, and perspectives. The small sample size in qualitative research is based on several factors, including the richness of data, variety of participants, sampling strategy, and data collection method (Creswell, 1998). To maintain uniformity in the lived experience of research participants, the sample size for the current study was small (see Polkinghorne, 1989). Some may argue that a small sample size risks the study's power and significance, rendering it meaningless (Bartholomew et al., 2021; Moser & Korstjens, 2017).

Significance

The findings of this study revealed several benefits to society, considering STEM careers play an essential role in the world (see Miller et al., 2017). The greater demand for STEM graduates justified the need to understand the experiences of African American students who reside in communities with limited opportunities and resources (see Assouline et al., 2017). The results of this study may provide implications for community agencies and nonprofit organizations to create community-based pipeline programs tailored to the needs of African American students living in rural communities. Program developers may use the findings in the study to understand how students experience the programmatic features of community STEM programs, specifically focusing on what students find most meaningful (see Shah et al., 2018). This may result in African American youths who live in rural communities benefiting from effective programs. Researchers have found that community-based programs deter problematic behavior and promote positive development (Farris et al., 2020). Community colleges and universities may gain insight from this study about the importance of lived experiences of rural students in STEM programs and tailor recruiting efforts for African American students from rural areas (see Strawn, 2019).

The findings from this study may raise awareness of the needs of youths living in rural communities, which may result in an increased representation of African Americans in STEM college majors, thereby narrowing the STEM career gap among this population. The findings may inform and improve school–community collaborative efforts. Finally, the findings may be used to understand students' experiences from rural communities that have yet to be explored, thereby affecting social change.

Summary

In this chapter, I provided background information about the educational challenges experienced in rural communities. I highlighted the underrepresentation of African Americans in STEM career fields and how this has become a national concern. The problem statement articulated the challenges African American students in rural communities face, including the low matriculation rates among this population. In Chapter 2, I review the research substantiating this phenomenological study's need.

Chapter 2: Literature Review

The purpose of this hermeneutic phenomenological study was to reveal and interpret the lived experiences of African American first-year college students in a STEM program and explore whether participation in a STEM program influenced their decision to pursue a STEM major in college. This chapter includes the literature strategy used to locate existing research that was significant to my study. Next, I describe the philosophical approach and theoretical framework, including the rationale for choosing this approach for the study. Last, I reviewed the studies that were relevant to the subject. The literature review provides existing knowledge of the topic, and I identify the gap in the research that justified the need for this study.

Literature Search Strategy

ProQuest, EBSCOhost, and SAGE databases identified relevant information about African American students from rural communities and community STEM-focused programs. Sources of information included peer-reviewed journal articles and local government statistics. The terminology used to find relevant information was as follows: *STEM*, *STEM programs*, *African Americans in STEM community-based programs*, *ecological systems theory*, *phenomenology*, *transcendental phenomenology*, *hermeneutics phenomenology*, *phenomenological variant of ecological systems theory*, *enrollment*, and *rural communities*.

Philosophical Approach and Theoretical Framework

I used a hermeneutic phenomenological approach and PVEST as a lens to understand students' lived experiences in a STEM program. Hermeneutic phenomenology, developed by Heidegger, is concerned with the life world and human experience as it is lived (Gadamer, 2006 Heidegger, 1962). The focus is on illuminating details about lived experiences to create meaning and new understandings (Wilson & Hutchinson, 1991). Developed by Spencer et al. (1997), PVEST is a framework used to examine individuals and their perceptions within communities and the wider society. Spencer (2006) suggested that context is essential when considering meaning-making processes. Individuals are in context, and the supports and challenges in these contexts must be considered when seeking to understand human experiences (Spencer, 2005). Spencer suggested that phenomenology should be used to underscore the importance of perception as an unavoidable part of humanity. Understanding the processes people go through when they perceive the world reveals more ideas for providing adequate support.

Phenomenology

Moustakas (1994) described phenomenology as an inquiry to capture and understand a human experience. Phenomenology is a philosophical movement that highlights lived experience as the source of the meaning and value of a human being (Blum, 2022; Moustakas, 1994). Among the many phenomenological approaches, transcendental and interpretative phenomenology are used to obtain an in-depth understanding of the lived experiences of research participants (Moustakas, 1994; Manen, 1992). In transcendental (descriptive) phenomenology, developed by Edmund Husserl, participants' experiences are described, and researchers' preconceived notions are bracketed (Moustakas, 1994). In hermeneutic (interpretative) phenomenology, created by

Heidegger, experiences are an interpretive process in an individual's life world (Reiners, 2012).

Transcendental Phenomenology

Husserl (1969) founded the philosophical movement of phenomenology. Husserl (1969) posited that phenomenology suspends all suppositions and is based on the meaning of the individual's experience. Husserl outlined four steps that provide a process for understanding the fundamental structure of everyday experience: intentionality, phenomenological reduction, description, and essence (Baker et al., 1992; Husserl, 1970). Husserl emphasized that "intentionality," also known as directed awareness, involves thought, memory, emotion, and imagination (Speziale et al., 2011; Moustakas, 1994).

Transcendental phenomenology is derived from intentionality, which is the idea of setting aside assumptions and beliefs (*epoche)* to see the phenomenon through a clear lens (Moustakas, 1994). This process allows the true meaning of the phenomenon to emerge in understanding what the research participants mean in their responses expressed through the data collection devices (Moustakas, 1994; Laverty, 2003). Husserl (1969) noted that immediate reflective self-experience should take the consciousness of life without prejudice through transcendental subjectivity. Husserl (1970) highlighted the "natural attitude" perspective of everyday life, which Husserl referred to as phenomenological reduction. Phenomenological reduction begins with bracketing, meaning the suspension of judgment (Moustakas, 1994; Sousa, 2014). According to Husserl (1970), phenomenology is used to capture direct descriptions of an experience without considering an account of its psychological origins and simple explanations, thereby creating descriptive phenomenology.

Central to Husserl's (1969) basic philosophical assumption is that researchers can only establish "knowledge of essence" because the essence is a fundamental meaning of shared experience within varying lived experiences. Husserl noted that a researcher seeks to describe the essence of a phenomenon by exploring it from those who have experienced it (Laverty, 2003; Moran, 2013). It is essential to emphasize Husserl's belief about phenomenology being presuppositional. From a transcendental phenomenological perspective, using additional theoretical frameworks in a phenomenological study would negate understanding a phenomenon (Husserl, 1970; Hart, 2019). A transcendental phenomenological study focuses on describing the experience and how it was experienced (Moustakas, 1994).

Hermeneutics Phenomenology

Heidegger, a student of Husserl, diverted from Husserl's position and proposed hermeneutics. Hermeneutics is an interpretive process that focuses on the interpretation and meaning of being in the world rather than knowing the world (Giorgi, 1997; Heidegger, 1982). Because interpretation is the nature of hermeneutics, researchers focus on historical and social contexts surrounding actions when interpreting a text (Gadamer, 2004). Heidegger extended hermeneutics to develop interpretive phenomenology. In contrast to descriptions or core concepts of the experience, hermeneutics seeks meanings embedded in everyday happenings (Dahl, 2022; Heidegger, 1994). Heidegger argued that bracketing is unwarranted in interpreting and describing the human experience because hermeneutics presumes prior understanding (Laverty, 2003; Parsons, 2010). Heidegger believed it was impossible to disaffirm prior understandings because they impact the interpretations of the phenomenon (Welch & Palmer, 1971). Heidegger's philosophy indicates that the essence of human experience is understanding the everyday world based on interpretation (Parsons, 2010).

Heidegger's hermeneutics phenomenology leans on the concept of "being there," which Heidegger referred to as *Dasein*. Heidegger (1958) posited that there is no way to separate oneself from being within the world and the circumstances of each one's existence. Heidegger (1962) postulated that existence is the experience of the human being. Heidegger further explained that to continue the rationale of Dasein, an individual must explore being in the world in the context of being with others (Heidegger, 1982). Derived from existentialism, being in the world emphasizes human existence as a state of living with a highly meaningful orientation and is a personal and unique experience (Dreyfus & Rabinow, 2016; Gadamer, 2004).

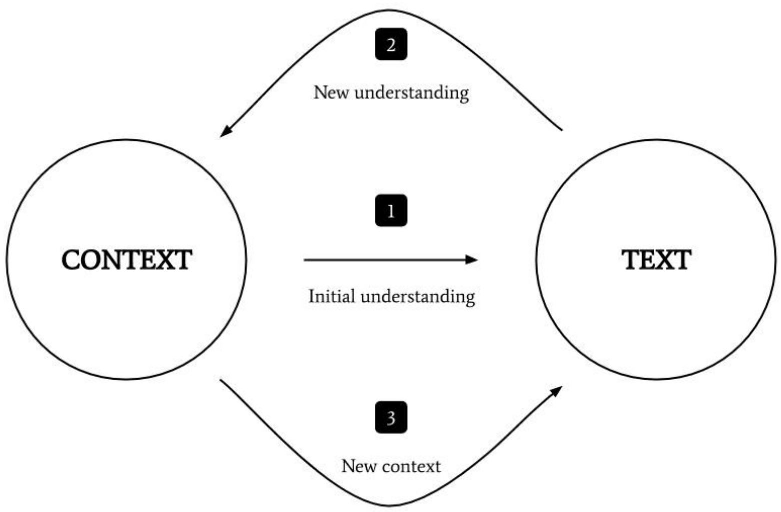
Heidegger argued that interpretations are never without presuppositions. Gadamer (2004) stated that understanding and comprehending the lived experience is an interpretative process, and bracketing preconceptions is not possible or desirable. Merleau-Ponty (1962) posited that people's biases, understanding, and judgments are revised as they understand and interpret information. In hermeneutics, the interpretative process is related to understanding. Heidegger proposed that every interpretation includes the fore-structure of understanding, which is a threefold structure of fore-having, foresight, and fore-conception, meaning having preexisting knowledge and experience of the world (Koch, 1996; Laverty, 2003).

Heidegger’s interpretation perspective is essential in researchers' approach to phenomenology. This approach allows the researcher to include their assumptions and preconceptions in the research process while seeking to uncover new understanding in the light of prior experience (Koch, 1996). Gadamer (2004) suggested that preexisting knowledge, expectations, and beliefs shape the interpretation of a text. Heidegger (1982) believed that new understanding is not based on established, permanently rooted beliefs but an ongoing, attentive, circular movement between individual parts.

Heidegger (1982) conceived the hermeneutic circle, which is a concept that refers to the idea that understanding the text as a whole is based on the understanding of its parts. Understanding how each part of the text refers to the text as a whole is the path to greater understanding (Scott & Gadamer, 1977). The level of understanding and renewed interpretation provides the possibility of a new meaning of presuppositions informing the understanding already possessed (Heidegger, 1958). Modification of understanding follows renewed interpretation that leads to a fusion of horizons (Gadamer, 1977). This concept suggests that understanding happens when present understanding moves to a new horizon because of an encounter (see Figure 1; Gadamer, 1989).

Figure 1

Hermeneutic Circle (Gadamer, 1989)



Hermeneutic phenomenology allows researchers to make credible interpretations and meanings representative of the participants' lived experiences. Using a hermeneutic approach, Abe and Chikoko (2020) explored the factors that influence career decision making of STEM students at a University in South Africa. Three themes emerged from the study, which suggested that intrapersonal influences, interpersonal factors, and career outcome expectancy influenced students' decisions to pursue a career in STEM. Abe and Chikoko found that using the hermeneutic approach provided an understanding of the varying student perspectives on career decision making. This provided implications for STEM educators because they help students make decisions that reflect their values and what they find meaningful about a potential STEM career.

A hermeneutic phenomenological design is helpful in STEM education, particularly regarding African American students. The hermeneutic phenomenological design allows researchers to give a voice to the people who have experiences in the study's context. According to the National Science Teaching Association (2018), African American women are underrepresented in STEM, and educators should create inclusive classroom environments for women of color pursuing STEM degrees. Johns (2018) conducted a case study that provided an understanding of the lived experience of African American female STEM students who attended a predominately White institution. Johns' use of a hermeneutic approach emphasized the importance of understanding African American female students' lived reality and the supportive environment they need to thrive in as undergraduate STEM majors. The themes emerging from this study revealed that African American female STEM students need support from their peers, affirming environments, formal and informal mentoring experiences, and validation from university professors that African American women belong in STEM careers (Johns, 2018).

PVEST

Phenomenology has contributed to understanding development in contemporary theories providing an adequate philosophical foundation while disclosing new insights. PVEST is a framework used to examine youth identity formation based on context and evolving understanding of self (Spencer, 2006). PVEST is a variant of Bronfenbrenner's (1979) ecological systems theory (EST). Within the EST framework, Bronfenbrenner (1986) placed individuals at the center of their ecology, which is often impacted by various settings throughout their life span. EST views child development as a multifaced system of relationships affected by multiple levels of the environment. This system may include direct family and school settings to broad cultural ideologies, values, laws, religion, and customs (Bronfenbrenner, 1977). EST identifies five environmental systems in which an individual interacts: the microsystem, the mesosystem, the exosystem, the macrosystem, and the chronosystem (Bronfenbrenner, 1986). Bronfenbrenner (1986) asserted that the five systems are interrelated and influence the child's development based on its relationship with others. Although students' skills and abilities play an essential role in their academic success, Bronfenbrenner (1986, as cited in Patterson, 2020) believed environmental systems are equally important.

Built on Bronfenbrenner's EST, Spencer et al. (1997) sought to make research on human development inclusive for youths of color. Spencer developed PVEST to address young people's historical, cultural, and social contexts. PVEST is a theory that deals with the relationship between an individual's view of the world and the impact of the historical, social, and cultural forces that impact their development (Spencer, 2006). PVEST is a culturally responsive framework and complements EST to include the phenomenological interpretations and responses of youths' behaviors and outcomes (Spencer & Tinsley, 2018).

As a systems theory, PVEST suggests that various aspects of individuals' lives are mitigated by perceptions about their supports and environments (Spencer et al., 1997). Positive perceptions of support systems, resources, and beliefs about themselves can positively impact an individual (Spencer, 2005). PVEST is beneficial for considering challenges relevant to African American youths and understanding how identity and resiliency may lead to various behavioral outcomes (Spencer & Tinsley, 2008).

Additionally, PVEST can provide a conceptual template to address issues associated with race and gender in an ecological context (Spencer et al., 2006).

Spencer et al. (1997) theorized that PVEST breaks down identity formation into five significant components. The first component is net vulnerability, which refers to contextual risk contributors (e.g., racial profiling, stereotypes, or disadvantaged treatment based on race) that may predispose individuals to adverse outcomes (Spencer, 2006). Spencer et al. (1997) suggested protective factors (e.g., community support, mentoring, parenting competencies, economic opportunities) can mitigate the impact of risk contributors, promoting healthy development and well-being of youths. Youths marginalized because of their race or upbringing in low-resource families must be aware of risk contributors and the protective resources available in their ecological systems (Spencer & Tinsley, 2008). Experiences of racism and discrimination can be risk contributors that potentially compound normative developmental issues such as puberty, forming peer relationships, and identity formation (Velez & Spencer, 2018).

Net stress engagement is the second component of PVEST and refers to the experiences marginalized youths encounter because of their minority group membership (Spencer et al., 1997). Acute exposure to these experiences and normative rebellious behaviors can lead to increased vulnerability to risk contributors, affecting an individual's well-being (Spencer & Tinsley, 2008). Spencer (2006) suggested that when resources and supports are available, individuals can navigate the adverse effects of risk contributors by actualizing protective factors. From this perspective, PVEST creates a link between context and authentic support (Spencer & Tinsley, 2018). Velez and Spencer (2018) emphasized the importance of adult role models, school resources, and community support to intervene during this stage. Although stress resulting from an adverse experience may be perceived as unfavorable and pose challenges, navigating stressful situations can empower youths to hone coping skills (Spencer & Tinsley, 2008).

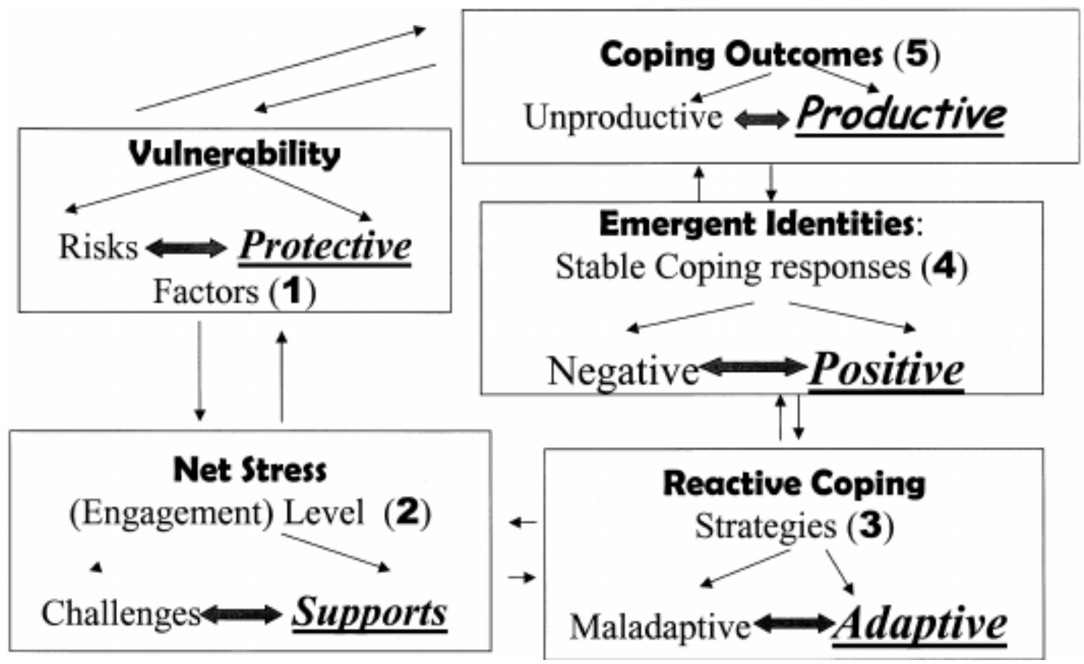
Individuals must learn how to cope with various sources of stress as part of normative human development. However, some stressors may be compounded for marginalized groups (Spencer et al., 2006). For individuals to effectively evaluate experiences and determine how to respond to challenges, they must develop a pattern of coping (Spencer & Tinsley, 2008). Reactive coping methods, the third component of PVEST, refers to an individual's use of coping methods to resolve dissonance-producing situations (Spencer et al., 1997). Individuals can learn problem-solving strategies that lead to adaptive and maladaptive behaviors (Spencer & Tinsley, 2008). The individual's ability to cope leads to positive self-appraisal and a desire to replicate behaviors that produce positive results for the ego (Spencer & Tinsley, 2008).

The fourth component of PVEST is the emergent identities stage, which occurs when individuals begin to view themselves within the surrounding contexts of their development (Spencer et al., 1997). At this level, coping strategies are repeated, stabilized, and self-appraised to form an identity (Spencer, 2006). Identity formation can include cultural and ethnic considerations, sex roles understanding, and self and peer appraisals (Spencer & Tinsley, 2008). The identity formation process can influence an individual's future perception, self-appraisal, and behavioral stability over time (Spencer et al., 2006). Spencer (2006) emphasized that during this process, individuals can also develop harmful or productive coping skills, which they use at specific life stages.

The life-stage specific outcomes component refers to the productive and negative coping strategies individuals develop through various stages of life (Spencer et al.1997). Spencer and Tinsley (2008) posited that youth who use adaptive coping methods to counteract adverse experiences are more likely to have successful transitions across life settings (community, home, school) over time. Positive experiences resulting from productive coping strategies become stable parts of how individuals perceive themselves and their futures (Spencer et al., 2006). Essential to this process is how individuals experience and understand the environments they are immersed in, which includes the risks, and available protective factors (Velez & Spencer, 2018). Resiliency built through various life stages despite adverse experiences results in positive outcomes (see Figure 2; Spencer et al., 2006).

Figure 2

Phenomenological Variant of Ecological Systems Theory by Spencer et al. (1995)



PVEST has been used in past research to examine the ideologies behind individuals' persistence, specifically how it has been impacted by various systems, including their local communities, families, and environments. Ozaki et al. (2020) used Spencer's PVEST framework to examine the psychological functioning behind students' persistence in community college. Using a PVEST approach, Ozaki et al. found that students who persisted in community college had phenomenological experiences around their student/learner identities. Students' negative and positive experiences caused them to reprioritize their self-perceptions based on how they perceived themselves as students and learners, thereby influencing their persistence in community college. This research revealed persistence patterns emerge when students' microsystems work together and specific resources are available.

Individual identity is formed through a variety of components. Spencer et al. (2006) asserted that an individual's identity is formed following daily life events that they experience and their cultural background. According to PVEST, individuals learn various methods to cope with their life experiences. Whether adaptive or maladaptive, individuals' methods of coping with their experiences contribute to their identity formation (Spencer & Tinsley, 2008). In a study conducted by Tope-Banjoko et al. (2020), researchers suggested that adaptive coping skills such as mindfulness and emotional regulation would contribute positively to students' academic identity. The study aimed to determine how effective mindfulness, cognitive-emotional regulation, and self-handicapping behaviors predict academic success in African American STEM students. Using PVEST, researchers found that students who use maladaptive coping skills are less likely to progress successfully in school than those with more adaptive coping skills. Implications of the study stressed the importance of incorporating self-regulation mindfulness practices in education.

PVEST is considered a framework that examines individuals' intersubjective experiences. Henfield (2012) used PVEST to understand how black males develop identities that may encourage them to expand or impede their willingness to participate in challenging academic contexts. Henfield suggested that educators or program developers need to consider the experiences of youth within their context and how such context-specific experiences lead to belief systems that develop over time. This substantiates Spencer's (2006) argument that self-perception can mediate or intensify connections between identities. Henfield's use of PVEST highlights the importance of helping black students explore and consider all advanced academic programs and classes. However, it is also essential to understand and address the risk contributors (e.g., race, environment) that may impact their success.

PVEST has shown to be a practical framework when examining African American women and their self-perception. Williams and Moody (2019) asserted that African American women could project their image and verbiage to articulate themselves. Morton and Parson (2018) used PVEST as a strengths-based approach to examine African American women's perception of how race and gender impacted their STEM identity and engagement. Qualitative analysis revealed the importance of African American women self-authoring their identities in STEM contexts (Morton & Parson, 2018). When African American women are allowed to accept and believe they have a place in STEM, they are self-confident to reveal their luster towards STEM education and careers (King & Pringle, 2019).

In this current study, hermeneutic phenomenology was used to reveal, understand, and interpret the lived experiences of African American first-year college students from rural communities in a STEM program. The PVEST lens was used to evaluate the emerging themes. PVEST provided an understanding of the role of contextual influence on the development and decision-making process of young people of color (see Spencer 2006). PVEST revealed the importance of meaning-making processes in how students understood and responded to their context-specific experiences (see Spencer 2006). People experience and understand a given phenomenon in different ways. Therefore, the perceptual process of individuals must be considered to understand the context and how human beings seek to understand and give meaning to the world in which they live (see Gadamer, 2004; Heidegger, 1982; Spencer et al., 2017).

Literature Review

History of STEM

The STEM acronym was introduced in 2001 by scientific administrators at the U.S. National Science Foundation (NSF) to refer to the disciplines and curriculum that integrated knowledge and skills from those fields (Mervis, 2001). Since 2001, a STEM-focused curriculum has been used, emphasized, and adopted in the U.S. educational system and abroad (Vogel et al., 2001). In 1957, the U.S. was challenged to become a science, technology, and math leader following the Russian satellite Sputnik into space (Mervis, 2001). The Sputnik era sparked great concern for Americans as it illuminated a perceived technological gap between the United States and the Soviet Union (Johnson, 2017). The Sputnik program was a series of five space missions, with the first being identified as Sputnik 1, the first satellite to be launched into orbit (Johnson, 2017). The launch created new political, military, and technological advancements. President Dwight Eisenhower invested additional funds and resources into the U.S. space program to catch up with technological advances in countries abroad (Bronisz, 1984). In 1959, The National Science Foundation received nearly $100 million in appropriation funds from the U.S. Congress than in previous years (Dickson, 2001). Congress passed the National Defense Education Act in 1958 to boost higher education and elementary/secondary education funding, emphasizing math and physical science (Tonne, 1958). Following

Eisenhower's presidency, President J.F. Kennedy continued pushing for innovation in science.

In the early 1980s, a continued push that encouraged STEM spearheaded many program initiatives that sought to foster interest in the field. In the 1980s, several technological advances were made, including the first cellular device, the artificial heart, the first Space Shuttle launch, and the first personal computer (Backus, 1971). Despite the increase in technological advances, researchers found an alarming gap between skilled and prepared STEM graduates and the number of jobs in the STEM field (Greenberg, 1991). This gap urged policymakers to emphasize reform and improve STEM education. Also, during this time, women dramatically increased their representation in the scientific labor force (Eccles et al., 1983). Despite the increase in the visibility of women in STEM, only a few women attained high levels within the higher education setting, and they remained severely underrepresented among senior-ranking positions in STEM (Smeding, 2012).

In the late 80s, the U.S. witnessed an increase in more specialized STEM high schools. Such schools were created to prepare students to meet STEM demands by offering rigorous curricula, qualified teachers, and more resources than a traditional high school setting (Thomas & Williams, 2010). Although specialized STEM high schools became more prevalent in many states, they continued to represent a small percentage of U.S. public education (Almarode et al., 2016). The National Consortium for Specialized Secondary Schools of Mathematics, Science, and Technology (NCSSSMST) was formed in 1988 to serve as a forum for schools to exchange information and program ideas while transforming STEM education and shaping national policy through research of model programs (Thomas & Williams, 2010). The National Science Education Standards and the National Council of Teachers of Mathematics worked to help educators in the K-12 system create curriculums that would better prepare students in STEM in the 90s. During this time, STEM was considered the directive of political agenda grounded in the need for vocational occupancy and economic imperatives (Kuenzi, 2008). A strong push from the government to fund STEM programs became a top priority because many students were opting out of STEM subjects and careers (Thomas & Williams, 2010).

In the early 2000s, STEM became increasingly integrated into educational and career reports. Trends began to forecast negative consequences that the U.S. global economy could face due to an unprepared workforce needing more knowledge in STEM areas (Cesarone, 2000). Advancement in STEM careers was connected to specific knowledge and skills (Courtney, 2015). STEM careers were critical to maintaining U.S. prosperity (Balaram, 2011). During this time, U.S. students progressed in STEM disciplines at lower rates than those who lived in different countries (Courtney, 2015). Historically, the U.S. ranked high for STEM education and opportunities. However, countries such as Singapore, China, South Korea, Japan, and Russia began ranking ahead, creating a need for Americans to maintain their competitive edge (Holt, 2000). As a result, greater attention was placed on STEM education and training to prepare people for those career fields (Holt, 2000; Lawson, 2000).

The STEM field is in demand, and continued research has shown that the supply needs to meet national demands. As baby boomers retire and the job market continues to grow, insufficiently qualified students fill positions (Sawchuk, 2018). In the U.S., a primary workforce goal is to promote STEM careers among racial and ethnic minority students (Stipanovic & Woo, 2017). One of the continued challenges of preparing African Americans for the STEM workforce is to address the systemic barriers that prevent them from access to the fields (Lancaster & Xu, 2017). The lack of opportunities in STEM and lived experiences make it challenging for African American students to develop a STEM identity that can lead to academic success (Jones, 2020). According to Rodriguez (2018), creating a STEM identity includes authentically demonstrating competence, confidence, and understanding of the subjects. Collins (2018) emphasized the importance of schools enhancing, reinforcing, and extending classroom learning with outside STEM opportunities and resources to influence STEM career choices.

The shortage of African Americans in STEM evokes even more significant concern for the U.S. due to the inability to fill STEM positions with competitive and diverse talent. Apriceno et al. (2020) asserted that the insignificant number of qualified STEM graduates increases the U.S. healthcare shortage. Policymakers and educators have stressed the importance of ensuring students transition from high school to college with the necessary skills needed for a world heavily influenced by STEM (Halling & Blount, 2017). Coleman (2020) suggested that an ongoing challenge in the U.S. is the disproportionate number of African American students who need access and exposure to the resources that would contribute to them becoming STEM-literate.

STEM teacher shortages are an ongoing concern as students need quality instruction to excel in STEM subject areas. Diekman and Benson-Greewald (2018) posited a STEM teacher shortage as math and science K-12 teaching appears to need more professional goal-oriented opportunities, discouraging interest. Kocabas et al. (2020) found that the quality of teachers is a cause for significant concern, as the lowest certification rate was found in science and mathematics. Researchers suggested that STEM educators face challenges and difficulties, including the need for continuous professional development (Spyropoulou & Kameas, 2020). Lucietto et al. (2018) believed that if an emphasis is not placed on STEM educators regarding their training, skills, abilities, and confidence, it can be challenging to encourage and engage students. A frequently referenced challenge for many STEM teachers is that their work environment and craft rely heavily on the ever-changing world of technology (Kim & Keyhani, 2019). Waite and McDonald (2019) stressed the importance of a teacher-centered systemic reform model and posited holistic and professional development programs to enhance teacher career resilience, abilities, and capacities.

Historically Black Colleges & Universities (HBCUs) have played a critical role in fostering American STEM education. To help students succeed in STEM, HBCUs have created goals that include soliciting additional funding, forming external partnerships, and collaborating with community stakeholders (Cain et al., 2018). Campus support and resources, peer study groups, and mentoring relationships from professors at an HBCU can contribute positively to students' success in these disciplines (Kendricks et al., 2019). However, Toldson et al. (2020) found that funding opportunities for computer science research and programs are limited, potentially impacting African Americans' participation in the tech field.

Community partners such as non-profit organizations, public agencies, government offices, and private businesses can play an integral role in student academic success. Many community partners create activities and programs that meet real community needs. King et al. (2018) suggested that connecting community partners with schools, teachers, and families has improved students' STEM outcomes. Researchers have shown that many community partners are investing more funding in schools and engaging students in various activities to strengthen the STEM talent pipeline (Zaza et al., 2019). Providing opportunities for students can be met with challenges for teachers in urban and suburban schools; however, Weiss (2019) argued that it could be overwhelmingly challenging to identify community partners in rural locations, especially if the school is small and underfunded.

Many corporate sponsors have been putting the youth first, and their generosity has been built into their social responsibility making it an integral part of their corporate agenda. Corporations such as Amazon, Google, and Microsoft support STEM education, providing sponsorships and opportunities for students to advance their future careers (Huston et al., 2019). Amazon Web Services (AWS) Educate provides a STEM program for students interested in working in IT and cloud professions (Journal Record Staff, 2019). AWS Educate provides resources for institutions, educators, and students. Google offers several internal programs that help educators and students develop technical skills in computer science and coding, such as the Made with Code program, which teaches teenage girls how to code (Nwokeji et al., 2020). In 2009, Microsoft Office founded the Technology Education and Literacy in Schools (TEALS) program. TEALS connects

Microsoft tech volunteers with school teachers to provide professional development to enhance STEM educational programs (Knowles, 2019).

Laws Geared Toward Improving Education in the United States

In 2001 Congress passed, and President George W. Bush signed the No Child Left Behind (NCLB) Act, which requires states to test students in reading and math in grades 3-8 and once in high school (U.S. Department of Education, 2004). Students were expected to meet or exceed state standards in reading and math. NCLB required states to develop assessments in basic skills and required all students to take them to receive federal funding. The NCLB Act revealed areas where students needed additional support and resources regardless of income, socioeconomic status, race, disability, or background (Marx & Harris, 2006). The main focus of NCLB was to close student achievement gaps by affording children a fair, equal, and significant opportunity to obtain a high-quality education (Walker, 2009). Many critics argued that the NCLB lacked a focus on science education, as evidenced by continuous low national science scores (Butz et al., 2003). The pressure, emphasis, and accountability placed on schools to prepare and assess students in language arts and mathematics led school officials to preoccupy their time and resources with those areas leaving a limited focus on science (Marx & Harris, 2006).

America COMPETES Act of 2007 (ACT 2007) was passed in 2007 and later reauthorized in 2010 as America COMPETES Reauthorization 2010 (ACA 2010), and was an initiative created to increase federal funding for physical science, engineering and improve the country's research infrastructure and STEM capabilities (Mervis, 2007). The Acts were passed to focus on streamlining federal efforts in STEM while keeping the

American workforce competitive in the global market (Yee, 2015). Two perceived concerns were believed to have influenced the U.S. global competitiveness (a) preliminary research and funding to create sufficient technological progress and (b) the low number of American students who excel and were proficient in science, engineering, and mathematics (Stine, 2008). The America COMPETES Acts have been recognized as the most profound science and innovation policy. However, many critics argued that ACA 2007 Act was signed too quickly despite the administration's concerns that the legislation includes excessive authorizations and duplicate programs (Stine, 2008). Tracking the Acts' effectiveness on physical science and engineering research, education, and infrastructure was challenging because authorizations can be specified on multiple levels (Robelen, 2010).

NCLB prescriptive requirements became overwhelming and increasingly difficult for educators and school officials to maintain. To respond to this issue, the Obama administration joined a call that included families and educators to create a more effective law that focused on preparing all students for success in college and careers (Every Student Succeeds Act, 2015). Every Student Succeeds Act (ESSA) was passed in 2015 and signed into law by Barack Obama. Students who attended low-performing schools and those who were not making positive academic progress received the funding and resources necessary to succeed academically (Stinson, 2015). Critics argued that ESSA was another initiative created by politicians and policymakers that needed to address daily issues faced by teachers, students, and families (Adler, 2019).

The STEM Education Act of 2015 emphasized computer science and supported STEM education programs at the National Science Foundation (US Congress, 2015). Through this Act, the director of the National Science Foundation awarded competitive grants to support innovative extracurricular and after-school STEM learning environments. Additionally, this Act required activities to include research and development geared toward improving the understanding of learning and students' engagement in informal STEM environments for teachers and elementary and secondary students.

In efforts to enhance STEM school-to-work pipelines for women and minorities, U.S. Congresswoman Joyce introduced the 21st Century STEM for Girls and Underrepresented Minorities Act, H.R. 1591. The bill was created for schools to enhance their engagement strategies for girls, young women, and minority students in STEM (Library of Congress, 2019). Federal funding specifically addressed professional development for teachers, enhanced outreach activities to parents, and exposed students to STEM mentoring and enrichment opportunities (Wayne & Frye, 2019).

To address the unique challenges faced by rural communities, Congress passed the Rural STEM Education Research Act in 2020. This Act was intended to support rural schools by providing rural teachers with professional development and stellar training opportunities in STEM and engaging students through state-of-the-art resources and hands-on education in their local communities (Rural Stem Education Act, 2021). The most recent effects of COVID-19 stressed the importance of this legislation as it highlighted many of the disadvantages faced by rural students who experienced many challenges to broadband access and distance learning (Webster, 2020).

The Rural STEM Education Research Act was introduced in Congress on January 2, 2021, and geared toward coordinating federal research and development efforts focused on STEM education and workforce development in rural areas (U.S. Senate Committee on Commerce, Science, and Transportation, 2021). This Act provides federal support for rural communities to implement the latest technological support to improve STEM education in academic settings. Policy and program initiatives targeting the inequalities faced by many students who live in rural areas can address challenges in accessing quality STEM education, whether caused by a lack of resources or a shortage of qualified teachers (Saw & Agger, 2021).

STEM Workforce

Demographic disparities and a need for diversity in many positions characterize the current STEM field. African Americans and Hispanics are underrepresented in the STEM workforce relative to their shares in the U.S. (Finkel, 2017). Researchers suggested increasing the domestic STEM workforce by attracting and retaining more minorities (Massat & Bryant, 2021). Although African American workers comprise 11% of the U.S. workforce, only 9% are STEM workers (U.S. Bureau of Labor Statistics, 2021). Additionally, African American women earn 10.7% of Bachelor’s, 13% of Master’s, and 1% of doctoral STEM degrees (National Science Foundation, 2019). According to the U.S. Bureau of Labor Statistics (2021), the U.S. needed to add roughly one million more STEM professions to meet the healthcare shortage and workforce in 2022.

Foreign-born non-citizens account for many U.S. Science and Engineering employment (Okrent & Burke, 2019). After receiving doctorate degrees in engineering, mathematics, computer sciences, and economics, many foreign-born students stay in the United States following graduation (Ransom & Winters, 2021). Reports have shown that Asians are overrepresented in the STEM field, considering their workforce share. Seventeen percent of college-educated workers in STEM are Asian, compared with 10% of all workers with a college degree (National Science Foundation, 2019). Further researchers have shown that subgroups likely to pursue a career in STEM are White and Asian males (Means et al., 2021).

Concerning gender, the STEM field is dominated by males because men continue to outnumber women in STEM careers. According to the U.S. Census Bureau (2020), women are employed in STEM fields at about half the rate of men. African American women comprise 1% of science and engineering professionals (National Science Teaching Association, 2018). Women receive four-year degrees at a higher percentage than men, 36.6% to 35.4%; it has been found that STEM degrees continue to attract more males than females (National Science Foundation, 2019). Educators, community leaders, and advocates stressed the importance of creating opportunities to increase female visibility within the STEM community (Barabino et al., 2020; Dunlap & Barth, 2019).

Although the research has revealed that males dominate the STEM field, black men represent 6.2% of the population with a bachelor's degree in science and engineering

(National Science Foundation, 2019). Black male students are continuously underrepresented in STEM disciplines, specifically in K-12 settings (Collins & Robertson, 2021). Many factors play into the underrepresentation of black men in STEM, including; lack of culturally responsive peer mentoring, low self-efficacy, underdevelopment of academic interest, and lack of support, as highlighted in much of the research (Burt et al., 2020; Davis, 2020). Though widespread initiatives and policies have been created to address the factors contributing to the low representation, the disparity among black men continues to persist (Williams et al., 2019).

STEM Education in Rural Schools

Many STEM careers require knowledge, specific skills, licensure, and college degrees. According to the US Department of Agriculture (2021), only 50% of people living in rural communities have at least some college education compared to 60% living in urban populations. Diversification of STEM fields continues to be promoted and encouraged; however, pursuing these fields is based mainly on the student's values, motivation, and perception of their abilities in a STEM career (Hite & Taylor, 2021). Further researchers have found that although underserved students are interested in earning a STEM degree, their admissions score benchmarks tend to be much lower than their peers (Benjamin et al., 2017; Lane et al., 2017). The K-12 in rural communities is characterized by limited resources, which tend to affect the quality of education necessary for students to excel on the college admission exams (Ontiveros, 2020). Liu (2018) found that inadequate high school preparation is a consistent barrier to students from rural communities' pursuit of STEM majors.

Although researchers have shown that rural students achieve high school diplomas at a rate comparable to urban areas, rural areas have lower educational post-secondary enrollment than nonrural ones (Ratledge et al., 2020). African Americans in rural areas comprise a large share of the population without a high school diploma and are less likely than Whites to have a bachelor's degree (National Science Foundation, 2019). According to the National Center for Education and Statistics (2022), 59% of rural students go to college but are more likely to drop out than students from urban communities.

Educationally, students in rural communities should be more noticed regarding education reform. In a report by The Rural School and Community Trust, minority groups in rural communities continue to be less likely than Whites to have a high school diploma (Showalter et al., 2019). Low educational attainment can be linked to higher poverty and unemployment rates (Ellis & Rowe, 2020). Rural students are less likely to take preparatory courses to help them achieve higher ACT scores than nonrural students (Rivera, 2019). Quality introductory educational courses are factors in addressing achievement gaps among rural students (OECD, 2021).

Rural schools face various and unique challenges in preparing students for post-secondary education in STEM. Researchers have found that students living in rural communities face geographic, technological, and economic barriers preventing them from pursuing a STEM career (Ihrig et al., 2018; Rivera et al., 2019). The pace that students graduate in STEM fields from rural communities needs to meet current workforce needs (Rivera et al., 2019). Although rural communities need help recruiting

STEM professionals and offering access to high-quality opportunities, researchers have found that students from rural communities were more likely to participate in afterschool programming than other students (Sheffield et al., 2018). However, the research on the students from rural communities' experiences and outcomes in out-of-school STEM programs is limited or outdated (Allen et al., 2019).

The lack of specialized training among teachers in rural high schools presents a challenge that hinders rural students' exposure to STEM. Many teachers in rural communities need more professional training and development in their respective disciplines (Durr et al., 2020). Kocabas et al. (2019) found that many teachers in rural communities do not possess a degree in their teaching subject. The lack of extensive STEM education and training causes high teacher turnover rates in rural communities (Harris & Hodges, 2018; Rivera et al., 2019). Tran et al. (2020) found more STEM teaching vacancies in urban and suburban schools. Researchers have found that rural educators often feel isolated from colleagues, specifically in their content area (Durr et al., 2020). The scarcity of resources makes it challenging for teachers in rural communities to participate in professional development training (Hudson & Hudson, 2019).

Preparing and teaching students academic skills can encourage them to become more efficient learners. Researchers have shown that solid academic preparation is a critical component of STEM readiness (Rezayat & Sheu, 2020). Academic preparedness for STEM learning in college is a crucial determinant of retention in STEM because minorities leave STEM majors at higher rates than other races (Liu, 2018; Rezayat &

Sheu, 2020). Rural students are disadvantaged because many need access to high-quality programs (Rivera, 2019). Due to financial limitations and trained professionals, rural schools often need help offering readiness programs beyond the general curriculum to prepare students for STEM in college (Ohlson et al., 2020). College readiness in STEM is predicated on students' ability to perform well in academics and college admission exams (Lane et al., 2017). Researchers have emphasized the importance of program developers at federal, state, and local levels to create strategies and programs that support student success in STEM disciplines in high school (Munn et al., 2018; Sithole et al., 2017). Continued research is needed to address programmatic component needs specific to rural communities (Harris & Hodges, 2018).

High school counselors are essential in ensuring students have solid educational experiences. The lack of knowledge about various opportunities in STEM among high school counselors in rural communities may impact a student’s future academic and career goals (Grimes et al., 2019). Rivera et al. (2019) study revealed that the knowledge of school officials could play a role in the majors that students choose in college. High school guidance counselors serve a unique position in helping students to become mentally and academically prepared for college and explore career interests and aspirations (Li et al., 2017). Edwin et al. (2019) highlighted the importance of high school counselors identifying students who express a strong interest in STEM and then utilizing career development interventions that have proven effective in encouraging students to pursue the major after high school. Shillingford et al. (2017) found that counselors often minimize the significance of their leadership role in improving STEM program opportunities for students living in rural communities.

Strong school leadership can play a role in student academic success. Researchers suggest that school principals drive change and improvement (Yang et al., 2020). School districts are continuously being challenged to improve their student's academic performance, and a strong administration is critical, especially in rural-resourced poor school districts (Klocko & Justis, 2019). Hosley et al. (2020) suggested that recruiting and retaining strong leadership in rural communities is a significant nationwide concern. The turnover rate of principals is higher for those who work in high-poverty rural communities (Azano et al., 2020). Many principals who work in rural areas have referenced the need for more resources, compensation, and removing barriers that support professional development (Klocko & Justis 2019). Schools thrive when the leadership provides innovative strategies and a defined mission and vision for the school (Hardwick-Franco, 2019). However, when principals leave their schools, progress is disrupted, teacher turnover increases and students' progress is stalled (Albritton et al., 2017).

Barriers to STEM Among African American Students

Several barriers have been identified that prevent underrepresented groups from entering STEM careers. Some of the cultural barriers contributing to the underrepresentation of African Americans in STEM careers are rooted in educational opportunities (Corneille et al., 2020). Lancaster and Xu (2017) suggested that many of the identified barriers are influenced by sociocultural factors rather than the lack of intellect among the population. Corneille et al. (2020) found that African American students are more responsive to STEM learning when culturally responsive STEM educational strategies are integrated into the classroom. Further researchers have found that African Americans' pursuit of STEM is primarily based on psychosocial factors such as support, environment, and self-perception in STEM (Estrada et al., 2018). Family involvement, peers, and mentors have been identified as factors in STEM academic achievement, especially among African American males (Fong & Kremer, 2019).

Most educators perceive their role in stimulating interests and curiosity as secondary to their primary goal of teaching STEM subject areas. Researchers have found that many students in the U.S. perceive STEM subjects as challenging (Dominguez et al., 2019; Michel et al., 2018; Vela et al., 2020). Students perceive STEM more favorably when motivated, acquire experience, and have positive self-efficacy (DiCosmo et al., 2021; Han, 2017). To add to this, Mau (2018) found that students who received high scores in math and science subject areas on standardized tests tend to gravitate towards an interest in STEM careers. Kruger et al. (2018) found that students refrain from pursuing courses if they are not confident about achieving high grades. Rezayat and Sheu (2020) posited that early exposure to STEM subjects might negatively affect career choices if students perceive the math or science courses they take in school as challenging. The perception of the difficulty becomes a barrier to STEM pursuits.

African American students in the U.S. demonstrate poor math and science skills compared to other countries (Liu, 2018; Sithole et al., 2017; Stipanovic & Woo, 2017). Researchers have further shown that African American students are more likely to leave a STEM major at higher rates than their White peers (Ohlson et al., 2020; Shah et al., 2018;

Sepanik et al., 2018). Given that specific skills are critical to excelling academically, many African American students believe they require more preparation for the rigor of STEM majors following high school (Lancaster & Xu, 2017; Rozek et al., 2017). According to the United States Department of Agriculture (2021), African American students from rural communities are less likely to study advanced mathematics subjects than their peers from more privileged backgrounds (Barshay, 2021).

Negative stereotypes and biases have also played a role in the disparities found in STEM careers. Researchers have found that African American students often form their identities amid stereotypes and prejudices (Maldonado, 2020). These stereotypes may be considered risk factors mitigated by solid supports, such as family, churches, neighborhoods, clubs, and other identified positive networks (Collins, 2018). Negative formed identities resulting from biases and stereotypes can impact self-efficacy and an interest in pursuing STEM training and career aspirations (Jouini et al., 2018). Corneille et al. (2020) suggested that many African Americans find it challenging to see themselves as having a place in the STEM career field. Developing a STEM identity that dispels negative stereotypes has been revealed to play a critical role in an individual's pursuit of STEM (Singer et al., 2020).

Rural communities tend to face school financial limitations and scarce resources, which presents an additional barrier to the development and availability of quality STEM programs. Resource availability, such as technology, access to state-of-art laboratories, and other institutional supports, have hindered students' educational aspirations (Harris & Hodges, 2018; Ihrig et al., 2018). Researchers have found that students may consider a

STEM major provided they feel confident in the academic preparation received while in high school and the availability of STEM-related extracurricular programs (Sheffield et al., 2018). The availability of STEM programs broadens participation and exposes youth to STEM disciplines, potentially leading to increased interest in the field (Rivera et al., 2019).

College recruitment fairs have been identified as essential in attracting aspiring college students. Jahic and Pilav-Velic (2020) suggested that higher education institutions are a primary source of shaping future employers and employees. College recruiters often help students to explore post-secondary options after high school (Olson, 2018). According to Olson (2018), many college recruiters from public universities tend to recruit students from affluent communities, and disparities have been found in off-campus recruiting. College recruitment focuses on wealthy high schools and disproportionately visited private high schools over public ones. (Elfman, 2018). Setterbo et al. (2017) suggested that recruiters shift their approach and focus on inclusion strategies that promote diversity and provide opportunities for students in rural communities to pursue a STEM major at universities and community colleges.

STEM pipeline programs in rural communities have been identified as another barrier preventing students' STEM access. Access to STEM extracurricular programs increases a student's interest in STEM and prepares them academically for the expectations and rigor of the disciplines (Rivera et al., 2019). Morton and Parsons (2018) suggested that STEM pipeline initiatives such as extracurricular activities, internships, and summer programs target underrepresented groups to increase STEM degree attainment. Although STEM pipelines are growing, researchers found a poor depiction of specific demographics having access, especially regarding gender, race, and impoverished communities (Casto & Williams, 2020). Verdin et al. (2018) argued that students from marginalized groups (e.g., racial/ethnic minorities, low income) are believed to have scarce professional and academic resources, resulting in different experiences than privileged students. Ihrig et al. (2018) asserted that students from marginalized groups identified as high achieving lack access to STEM programs, further widening the excellence gap. Pipeline programs can create unique opportunities to help students in rural communities actualize their full potential.

Parental barriers may include parents' perception of STEM programs as a financial challenge, limiting their children's opportunities. In a study examining parents' perceived barriers to engaging their children in out-of-school STEM programming, Sepanik et al. (2018) found that many parents prefer free programs situated in local communities and coordinated by highly regarded education institutions. Additional barriers included parents' inability to participate in the programs with their children due to conflicting work schedules and the lack of community workshops to understand various STEM opportunities (Showalter et al., 2019). Davis (2020) suggested that program developers take an ecosystem community-based approach to address the challenges.

Factors That Influence Students' Interest in STEM

Access and exposure to STEM-focused high school programs bring awareness and enhance students' interest in STEM. Various researchers have shown factors that positively influence youths' motivation and persistence in STEM-focused degree programs (Mohd et al., 2018; Totonchi et al., 2021). Mtika (2019) found that STEM programs provide students with relevant subject knowledge, enhanced learning opportunities, and confidence in their abilities. STEM program participation in high school correlated with college matriculation and positive STEM-related outcomes (Bottia et al., 2017). Vela et al. (2020) found that out-of-school STEM-focused programs contributed to students' interest in STEM because they allowed them to make meaningful connections between their academics and daily lives.

Capturing students' interest in STEM content at an earlier age is a proactive approach to ensuring that students are prepared and on track to face the rigor of STEM coursework. Researchers have shown that early exposure to STEM opportunities and education has positively impacted elementary students' perceptions and dispositions (Rezayat & Sheu, 2020). According to the National Assessment of Educational Progress report (2019), 66% of U.S. fourth-graders need to be proficient in math. Researchers revealed that early exposure to STEM education could make a significant difference, specifically in closing achievement gaps for low-income students (Dvorin & Center for an Urban Future, 2020). African American youths can benefit from early exposure because opportunities can develop their interests and identities (Dailey et al., 2018).

Self-efficacy has been a widely explored construct when looking at factors that motivate students to STEM. Researchers have found that solid self-efficacy has been connected to improved academic performance (Mark & Wells, 2019). Bandura's (1977) self-efficacy theory is the belief that one can achieve a particular outcome. Higher self-efficacy could result in an individual setting higher goals and achieving them (see Bandura, 1977). Wang and Frye (2019) found that STEM enrichment programs foster self-efficacy. In a study examining extracurricular activities and academic motivation for rural area students, Baran et al. (2019) found that participation in activities beyond the traditional school setting predicted firmer beliefs of academic competence, thereby increasing self-efficacy. Rosecrance et al. (2019) argued that a gap between college aspirations and college enrollment among rural high school students demonstrates a need to understand their beliefs and attitudes about higher education.

Students' motivation and persistence increase following participation in supplemental STEM-focused programs. Stringer et al. (2019) study about the difference in STEM extracurricular program participants and non-participants found that participation increased STEM career identity and science motivation. In a high school longitudinal study conducted by Young and Young (2017), researchers found a direct relationship between out-of-school enrichment and black student participation in advanced science. Lane et al. (2017) also revealed that STEM enrichment programs foster interest in STEM for high school students, particularly those of color.

Parental attitudes and engagement have also been connected to students' interest and motivation in a STEM discipline. Rodriguez (2018) suggested that parents significantly influence their children's education and career development. Rozek et al. (2017) conducted a study that examined the long-term effects of theory-driven interventions designed to help parents communicate the importance of STEM-based courses to their high-school-aged study. The results suggested that motivational interventions can affect STEM pursuit indirectly due to the increased interest in high-school STEM preparation among their children. Hung et al. (2020) suggested that parents can transfer abundant knowledge and influence their children in informal and formal ways. Parental attitudes and engagement are essential in rural communities, where data has shown that parents tend to hold lower expectations for STEM career advancements than those in urban communities (Harris & Hodges, 2018). Moreover, a family member's career has been found to impact a student's STEM interest. When students are exposed to STEM early on due to their parents, caregiver, or relatives' profession, they become more aware of the rigor and STEM opportunities (Zhou et al., 2017).

High school experiences have also increased interest in the STEM disciplines. Researchers suggested that students who do not have backgrounds that include exposure to STEM feel academically less prepared and do not typically choose to pursue a degree in the discipline (Lane et al., 2017). Sithole et al. (2017) postulated that students' interest in STEM could include their positive experiences in math and science courses. Students who perceive their mathematics and science abilities positively in high school tend to develop an interest in STEM (Ihrig et al., 2018). To further this point, Mau and Li's (2018) findings suggested that subject-specific self-efficacy strongly indicates STEM career aspirations among high school students. Rivera et al. (2019) showed that students who live in rural communities might need more course offerings in high school, which may impede their skills and abilities in specific subject areas.

In a study examining high school students from rural high schools' perceived barriers to pursuing college, Morton et al. (2018) discovered that students expressed concerns and worries about college readiness citing a lack of preparation, resources, and opportunities necessary to be deemed prepared for college. Morton et al. found that adequate high school preparation in STEM subject areas and admissions examinations was associated with increased STEM career pursuit. Although supplemental instruction needed to prepare high school students for the rigor of STEM has been integrated into many school curricula throughout the U.S., a gap exists in access to these educational opportunities for students who reside in rural areas (Harris & Hodge, 2018).

Minorities persist and pursue STEM-related fields when they identify personal relevance to the career field (Hung et al., 2020). Students develop an interest in STEM when knowledge of the disciplines can be applied to the practical world of work (Mtika, 2019). Researchers have shown that students are not interested in science careers when they need to clearly understand the specific job responsibilities (Sithole et al., 2017). To add to this, Munn et al. (2018) suggested that students are inspired to pursue STEM when they believe that science has something to offer them and can be a part of their future education and career plans. Ko and Marx (2019) found that students' interest in STEM increases when the emphasis is placed on the benefits and what the various career fields can offer.

Peer mentoring has been identified as another positive factor influencing students' decision to pursue STEM. Much of the research shows the impact of peer mentoring at the post-secondary level (Fuller et al., 2018; Kilpatrick & Fraser, 2018; Spaulding et al., 2020). However, peer mentoring has been incredibly beneficial at the high school level as it fosters the development of young STEM professionals while nurturing their interest in the career fields (Clark, 2020). Rivera et al. (2019) suggested that building STEM ecosystems such as peer mentoring programs is essential in increasing the number of STEM professionals in the United States. Although STEM mentorship programs have become more popularized, the research on effectiveness and impact on rural communities has lagged (Kupersmidt et al., 2018). However, what is known is that STEM mentor programs in rural communities require mentees to be paired with peer mentors who share similar backgrounds, interests, and experiences (Stringer et al., 2019).

National STEM-Focused Program Initiatives

Due to the national shortage of healthcare workers, various program initiatives have been created in rural communities to expose students to STEM. Advancement Via Individual Determination (AVID) is one of the efforts made in Central Florida to strengthen academic program rigor and teacher selection and equip students with skills to transition between high school and post-secondary education (Peabody, 2012). The AVID program includes resources for teachers to strengthen their professional capabilities and learn evidence-based strategies to prepare students for success, thereby closing achievement gaps (Sepanik et al., 2018). Teachers also learn how to help students enhance critical thinking, reading, and writing skills while building time management, note-taking, and study skills needed for college (Sepanik et al., 2018). Many students selected to participate in the program are from underrepresented rural communities. In a research program educational report, AVID participation in Houston was concluded as performing statistically significantly better than those students who did not participate in the AVID program (Houston Independent School District, 2017).

Upward Bound is a program that has been identified as playing a role in increasing minorities' completion of STEM degrees. Developed in 1965, the Upward Bound program provides educational resources and support to high school students from low-income and identified as first-generation (McElroy & Armesto,1998). The main goal of Upward Bound is to increase the visibility of students who pursue and complete secondary education. The program provides academic support and instruction in mathematics, science, composition, and foreign languages. Additional support includes tutoring, mentoring, counseling, cultural enrichment, and financial literacy (Exum & Young, 1981). The Upward Bound Math-Science program is also offered through the TRIO program. It focuses on helping students realize their potential in math and science courses while encouraging them to pursue a STEM degree (Olsen et al., 2007). Despite the positive impact of the Upward Bound program on students' lives, limited research highlights rural students' actual experiences in the program (Grimard & Maddaus, 2018).

Students benefit from the hands-on activities integrated into a STEM high school curriculum. Project Lead the Way (PLTW), a STEM-focused interdisciplinary platform, was developed in 1986 to diversify the classroom experience by incorporating various components of STEM subjects into hands-on activities in the K-12 school system across the United States (Stebbins & Goris, 2019). The overall goal of PLTW is to increase students in the K-12 school system's interest in STEM. In later years, PTLW was modified and tailored to focus efforts on engineering to be added to the high school curriculum (Stebbins & Goris, 2019). Many educators have adopted the PTLW curriculum as a supplementary resource for the high school core curriculum (Covault et al., 2017; Lee et al., 2018). Covault et al. (2017) considered the PTLW curriculum the model for developing, funding and sustaining a success-driven engineering program in the U.S. school system. Utley et al. (2019) conducted a transcript analysis to compare the incoming first-year students who participated in the PTLW while in high to those who did not participate in the program. Data revealed that students who participated in the PTLW program in high school progressed into their sophomore at higher rates than non-participants, especially among minority students (Utley et al., 2019).

STEM Program Availability in Rural Communities

Students living in rural communities face various challenges and limitations that prevent them from participating in activities that expose them to STEM opportunities. The lack of STEM program opportunities in rural communities makes it challenging for students to gain hands-on experience without leaving their homes (Allen et al., 2019; Munn et al., 2018). For students living in rural communities, exposure to career professionals in STEM and access to community-based programs are often found in urban areas (Munn et al., 2018). Harris and Hodges (2018) found that although rural communities and urban regions share some of the same student attributes related to socioeconomics and testing achievement, one of the main differences is the amount of funding urban schools receive for community-based programs. Students from rural communities often face the challenge of traveling far distances to participate in shadowing or STEM program opportunities (Sheffield et al., 2018). Sheffield found that partnerships that include families and communities beyond the school level must be formed to provide STEM program opportunities for students who live in rural communities. To add to this point, Allen et al. (2019) found that enhancing rural students' participation in STEM involves exposing, educating, and connecting them to local STEM opportunities.

Early exposure to STEM plays a vital role in driving the continued interest among young people. Edwin et al. (2019) found that to encourage students to aspire to STEM career goals, students need to be exposed to STEM disciplines and information about STEM career pathways. Additionally, researchers have found that STEM program opportunities need to be connected with students' lives (Rivera et al., 2019). To add to this point, Allen et al. (2019) found that students benefit from community programs that offer first-hand experience and support and foster meaningful involvement. Locally available community programs can play a crucial role in increasing students' interest in STEM as a career (Harris & Hodges, 2018). In their descriptive analysis of students who participated in a STEM-focused community program, Sheffield et al. (2018) indicated that one key takeaway was students' need to access local resources and opportunities. Munn et al. (2018) emphasized the importance of demonstrating to students that resources are accessible in the community in which they reside. Access to community resources provides a foundation in which students pursue higher education (Ontiveros, 2020).

STEM programs must be attractive, engaging, and relevant to maintain students' interest. Kinskey (2020) found that students' interest and motivation can also be evoked when they see images to which they can relate. The study revealed that images that connect science to relatable life experiences, people, and careers could increase students' interest in STEM. Students benefit when they are exposed to and provided with opportunities to talk and learn from other professionals who are knowledgeable about their respective careers (Munn et al., 2018). Allen et al. (2019) postulated that one of the challenges faced in rural communities is that students have limited opportunities to professionally and academically engage in STEM-related opportunities of their specific interests.

STEM programs must be quality and geared towards inciting students' interest and developing their skills for subject areas and career fields. In a national study of afterschool STEM programming, Allen et al. (2019) found that quality STEM programs can lead to youth development and STEM learning approaches that can improve outcomes for youth. Although more community programs have been identified in rural communities, ongoing research is required to examine positive program trends for African Americans who live in these areas (Harris & Hodges, 2018; Ohlson et al., 2018). Despite a push to increase STEM program visibility due to the national shortage of healthcare workers, only a few large-scale efforts have been shown in rural communities (Harmon, 2021).

What Research Says About Rural Students

Gaining insight into the characteristics of the rural student can be beneficial as many seek to create programmatic efforts geared towards exposing this population to more STEM opportunities. The U.S. Census Bureau (2020) characterizes rural areas as regions with fewer than 50,000 people located five miles from an urbanized area. According to the U.S. Census Bureau (2020), 60 million Americans who live in rural areas represent 20% of the population. Most students who live in nearly half the states are from low-income families (Crumb & Chambers, 2020). Rural minorities are more likely to live in subsidized, substandard, and cost-burdened housing (Saw & Agger, 2021).

Although some rural schools thrive, many are overlooked because stakeholders need to understand rural communities' challenges. Most rural students attend school in a state comprising less than 25% of public school enrollment (Showalter et al., 2019). According to Showalter et al. (2019) in a Why Rural Matters Report, many U.S. rural schools are small, with a median enrollment for rural districts of 494 students. Although the rural community is becoming increasingly more educated, educational attainment varies across demographic groups (Tran et al., 2020). Cultivating STEM literacy and proficiency in K-12 rural schools remains an ongoing challenge (Allen et al., 2019). More recently, the pursuit of online education has been more of a concern in rural areas because many residents stated that accessing high-speed internet is an ongoing issue (Friedline, 2020).

Students in rural communities experience unique problems related to academic performance and progression. Researchers revealed that rural students enroll in college at lower rates than suburban and urban areas (Rosecrance et al., 2019; Sepanik et al., 2018; Sithole et al., 2017). Students from rural communities have been shown to score generally lower on standardized school assessments because they need access to rigorous coursework that prepares them for the coursework in college (Rivera et al., 2019). Researchers have found that although rural students are less likely to pass advanced placement courses to qualify for college credit, they lead in dual enrollment credit hours for college credits (Azano et al., 2020; Showalter et al., 2019; Weiss, 2019).

Rural students face many barriers and only sometimes have the same access to opportunities as their peers in urban and suburban areas. Often, rural students are challenged to take classes with an inexperienced teacher who may be overloaded with courses and need more time to collaborate with colleagues or receive adequate professional development (Sepanik et al., 2018). Sithole et al. (2017) argued that many teachers need help to improve their teaching techniques or discover strategies to enhance students' interest in STEM courses due to the lack of resources and demand. The damaging effects of poor-quality STEM education further widen the achievement gap among students living in rural communities (Harris & Hodges, 2018).

The distance between rural students' homes and opportunities can be a barrier to pursuing STEM programs and college. Researchers have also revealed that many students in low-income rural communities do not want to leave their communities and often face pressures at home (Means et al., 2021; Rivera et al., 2019). Many rural students are born and raised in their town and have yet to be exposed to areas that have more than their small town offers (Means et al., 2021). Rural students have ties and strong connections to their community, which shapes their educational aspirations (Morton et al., 2018). They are also faced with making difficult choices of remaining in the local community where resources dwindle and relocating to urban or suburban areas where more opportunities are available (Payne et al., 2018). Many rural students are intimidated and afraid of exploring beyond their communities without their parents or caregivers (Rivera et al., 2019; Zhou et al., 2017). Harris and Hodges (2018) highlighted that local culture is essential when considering the rural student and their community. Harmon (2021) found that students pursue specific majors in college when they have experienced or been exposed to them in their local context.

Many rural students need more local professionals in their desired career interests. Although 20% of the U.S. population resides in rural areas, only 9% of US physicians practice there (American Association of Medical Colleges, 2019). Opportunities to meet professionals are met with the challenges of geographical location, socioeconomic disadvantage, lack of time, and parental involvement (Munn et al., 2018). The opportunity to network and talk to professionals in STEM fields to understand the steps required to enter the profession can strengthen the pipeline (Patel et al., 2017). Career development suffers in rural communities because the presence of local professional role models needs to be improved (Bright, 2020). Researchers suggested that one-on-one contact with established STEM professions and underrepresented groups has been shown to foster the STEM connection with students in rural communities (Ramsay-Jordan & Jett, 2020).

The impact of parental education and income can be among many salient factors that influence student success. Researchers have shown that rural students from families with advanced degrees or an income of $50,000 or more were more likely to attend college and receive a degree than those whose family income was $25,000 or less (Ontiveros et al., 2020). Betancur (2018) also found that parents' education and family income influenced science and math achievement among African American students.

Rural counties have shown a strong relationship between low educational attainment and high poverty and unemployment rates (Showalter et al., 2019). As shown in research, household education attainment is strongly correlated to achievement gaps, as advanced levels of education have been associated with more significant achievement gaps (Hung et al., 2020).

Financial resources may prevent rural students from participating in supplemental programs that are not free or available in the local community. Extracurricular activities have been shown to positively affect students' interest in STEM more than science courses (Rezayat & Sheu, 2020). Students who live in low socioeconomic rural communities face attending schools with lower funding levels and limited STEM learning material (Verdin et al., 2018). Extracurricular activities can bridge the gap that can address the access and persistence of rural students in STEM careers (Young & Young, 2017). However, identifying critical programmatic components based on lived experiences have yet to be fully explored (Lane et al., 2017).

Contrary to much research, only some students living in rural communities perform well. Many rural students have been identified as high achieving and, when provided with adequate support, can perform well and graduate at higher rates than students generally (Patterson, 2020). High-achieving students often face the unfortunate barrier of under-resourced schools that ultimately provide fewer options for academic advancement than their similar-ability peers from more affluent communities (Assouline et al., 2017). More research to understand the career aspirations of African American rural students is needed to create culturally responsive opportunities for them (Totonchi et al., 2021).

Rural Student in Florida

Florida is one of the states with the highest number of students enrolled in rural schools. As stated earlier, Florida has more than 150,000 students who attend schools in rural communities (Showalter et al., 2019). The graduation rate of rural minorities in Florida is 64.2% compared to the national average of 87.3% (National Center for Education Statistics, 2022). Nearly one in five of Florida’s rural students live in poverty, and many schools serve a disproportionately high number of students of color (Showalter et al., 2019). The poverty rate in rural Florida is 18.8%, compared with 12.6% in urban areas of the state (U.S. Census Bureau, 2021). Many school districts in Florida are comprised of STEM teachers with a high concentration of low-income students who attend school in rural communities (Power et al., 2020). According to a 2020 report by The Florida Council of 100 (2022), nearly 9 out of 10 STEM jobs will become available in Florida over the next decade.

Florida rural communities have seen an increase in STEM program visibility. Rural Initiative for Stem Education (RISE) is a program geared towards building connections among students, schools, higher education leaders, businesses, and industries to develop a STEM workforce for Florida’s rural regions (NEFEC Rise, n.d.). FloridaLearns STEM Scholars (FLSS) program was designed to make more rigorous STEM courses available. The program is offered in the summer and is led by faculty from various universities and STEM professionals (Nicholson, 2014). FLSS provides hands-on activities, STEM research opportunities, and academic and career guidance from qualified professionals (Nicholson, 2014). Despite the increasing number of program initiatives in Florida, only 3% of all students will graduate with a STEM credential (National Center for Education Statistics, 2022). Many who pursue college are undecided majors (Ohlson et al., 2020).

Summary and Conclusions

Chapter 2 explored the literature on African Americans' underrepresentation in the STEM field. This chapter revealed the U.S. challenges in employing skilled healthcare workers to decrease the healthcare shortage, the underrepresentation of African Americans in STEM careers, and the challenges faced by students who live in rural communities. The literature review provided information about rural communities' lack of educational resources and access to STEM career pipelines that adequately prepare them for the rigor of STEM college disciplines. Additional information highlighted laws that address education in the U.S., factors that motivate students to pursue STEM, barriers preventing students from entering STEM careers, and current programs geared towards exposing youth to STEM opportunities. In recent years, there has been an increase in program availability and visibility in rural communities; however, there is limited research related to students' lived experiences in these community programs, as shown in the literature (Harmon, 2021; Harris & Hodges, 2018; Rivera et al., 2019). Despite the significant number of program initiatives and laws geared toward increasing the number of skilled STEM workers, the underrepresentation of African Americans in STEM still needs to be solved (Zaza et al., 2019).

Based on the research found regarding African Americans' participation in STEM programs and the barriers that prevent their pursuit of STEM careers, there needs to be more research that examines African American first-year college students from rural communities and their lived experiences in STEM programs and whether their STEM experiences influenced their decision to pursue a STEM major in college. The gap in the literature associated with the experiences of African American first-year college students who participated in a STEM program will be addressed. As outlined in the literature review, researchers, policymakers, and program developers continue to demonstrate an interest in enhancing STEM education and opportunities for rural communities (Allen et al., 2019; Assouline et al., 2017; Betancur et al., 2018). Addressing the challenges highlighted in the research may narrow the gap and attract funding for this specific research area. Results from this research may spearhead new funding initiatives for rural communities or increase currently available funding, thereby acknowledging that the African American rural student population represents the U.S. untapped potential in STEM post-secondary education and careers. Chapter 3 presents details regarding the research design used for this hermeneutic qualitative study, the rationale behind the selected design, the role of the researcher, the recruitment process, instrumentation, data collection, data analysis plan, ethical considerations, and a summary.

Chapter 3: Research Method

The purpose of this hermeneutics phenomenological study was to explore the lived experiences of African American first-year college students in rural communities who participated in a STEM-focused program before college and whether those experiences informed their decision to pursue a STEM major in college. A hermeneutic phenomenological inquiry provided a rich and detailed description of students' lived experiences, resulting in a complete understanding by revealing the unknown aspects of the STEM program within the experience. Using hermeneutics as a methodology allowed me to understand what students found to be meaningful parts of their experiences. Understanding the students' experiences helps stakeholders make significant financial contributions to program development and implementation (Rivera et al., 2019). This chapter addresses the applicability of this study's philosophical approach and theoretical framework. The research design and rationale, the role of the researcher, methodology, data analysis, trustworthiness, and ethical procedures are also discussed in this chapter.

Research Questions

To conduct this phenomenological study, the following research questions were used to focus on the participants' lived experiences: What are the lived experiences of students from a rural community in a STEM program? How did the experiences influence their decision to pursue a STEM major in college?

Research Design and Rationale

A qualitative approach is appropriate to explain a phenomenon. Qualitative methodology produces rich textual descriptions from people who can connect with the experience (Wolff-Michael, 2015). Qualitative methodology allows the researcher to examine a situation through the person's lived experiences (Creswell, 1998). In the current study, qualitative methodology allowed me to understand students' subjective realities of STEM programs and develop a deeper understanding of those experiences. The current qualitative inquiry gave students a voice to share their stories and experiences. A qualitative approach is appropriate when there is a need to understand a phenomenon as explained by the individuals who experienced the research subject (Creswell, 1998).

Phenomenology was developed to explain how individuals give meaning to social phenomena experienced in their everyday lives. Moustakas (1994) contended that phenomenology describes how true meaning within the social world themes, ideas, and occurrences might be identified by the researcher and a participant in a combined interpretative response to data. Central to a phenomenological approach is the researcher's understanding of two main philosophical foundations underpinning the research (Peoples, 2020). Polkinghorne (1989) postulated that phenomenological studies must address the exact philosophical stance. In doing so, the reader can judge the study's validity and findings (Giorgi, 2004). Phenomenological research follows the broad philosophical traditions of Husserl (transcendental) and Heidegger (interpretive) that theorize the meaning of human experience (Reiners, 2012). Husserl (1970) argued that the transcendental or descriptive methodological approach suspends all suppositions and is based on the meaning of the individuals' experience. Heidegger (1982, as cited in Gadamer, 2004) posited that interpretation and analysis of textual information enhance the understanding of the meaning of the day-to-day experiences of research participants. This kind of phenomenology requires the researcher to embrace and read deeply into the philosophies that serve as the foundation of this tradition to grasp the principles of thinking, reading, and writing (Gadamer, 2004).

A hermeneutic phenomenological approach provided methodical guidance to elucidate the lived experiences of African American first-year college students from rural communities who participated in a STEM community program before college. I also explored how the experiences influenced their decision to pursue a STEM major in college. Hermeneutic phenomenology acknowledges that humans are situated in realities formed by subjective experiences (Gadamer, 2004). Heidegger (1982, as cited in Holroyd, 2007) argued that it is impossible to suspend experiences related to the phenomenon under study and asserted that personal awareness is interwoven with phenomenological research. Hermeneutics phenomenology was developed as a research tool for collecting rich and deep textual descriptions of a lived experience (Reiners, 2012). Employed as a research methodology, a hermeneutic phenomenological approach provided me an opportunity to give students from rural communities a voice within the context of the study.

The hermeneutic approach was most suitable for this study because it allowed me to explore and interpret these experiences based on my theoretical, professional, and practical knowledge. Gadamer (1977) argued that the researcher’s prejudices are integral to the research process and should be carefully examined because they influence the study. I entered this study with preunderstandings of STEM programs and students from rural communities, which were influenced by my personal experiences and extensive work in higher education. Heidegger (1982, as cited in Gadamer, 1977; Welch & Palmer, 1971) argued that impartiality is impossible in a hermeneutic approach and endorsed the application of the hermeneutic circle, where understanding and interpretation of phenomena are gained through shared knowledge and experiences. Gadamer (2004) noted that the hermeneutic circle of interpretation never closes and continues with the movement of understanding shifting from the whole to the part and back to the whole. The hermeneutic circle helped me refine my interpretation of the student's experiences. During the interpretive process, a new understanding was achieved through renewed interpretation of students' experiences as participants in a STEM program.

Theories can also be used to help understand the findings of a study. I used PVEST as a lens to gain a deeper understanding of the final themes that emerged from the data analysis. PVEST is used to answer the "how" and "why" questions but, more importantly, emphasizes that perception matters and is linked to context (Spencer et al., 1997). According to Spencer (2006), PVEST highlights the role of context and emphasizes the diverse needs of people of color. People experience or understand a given phenomenon in various ways. Researchers must consider the perceptual process to ensure they get the opportunity to know how people understand and experience context, its supports, or the absence of supports.

Like hermeneutic phenomenology, PVEST increases understanding and can help researchers and educators interpret students' experiences based on the context, which is often socially constructed to affect their outcomes (Spencer, 1997). Spencer (2006) suggested that context is essential when considering meaning-making and coping processes. Individuals are in contexts, and the supports and challenges in these contexts must be regarded when designing authentic support (Spencer, 2006). I captured the descriptions of the students' lived experiences and discovered the meanings of those experiences in their specific contexts. PVEST revealed how students within the same racial but different rural communities developed a unique sense of identity. This process of identity formation is based on context and individual meaning-making experiences. Spencer (2006) suggested that phenomenology should be used to underscore the importance of perception as an unavoidable part of humanity. Understanding people's processes when perceiving the world provides more ideas for creating adequate support. As I examined students' experiences through the PVEST lens, I gained a new understanding of how students experienced the program and, more importantly, how they interpreted the experiences that led to their decision to pursue a STEM major in college. I created a new way of knowing and understanding the experiences of African American students from rural communities in a STEM program.

Role of the Researcher

As the researcher in this study, I was the key instrument for data collection, and my reflections on the research process added to the contextual richness of the study. Moser and Korstjens (2017) suggested that researchers serve as instruments to use their senses to grasp study objects paralleling them in their awareness, then converting them into phenomenological representations to be interpreted. Students felt safe and comfortable sharing their experiences through facilitative interaction and conversations. I described the participants' lived experiences and discovered the meanings of those experiences in their specific contexts. The phenomenology of Heidegger (1982) suggested that a hermeneutic study requires researchers to be active and purposeful, not merely a data collection tool. Researchers should not be detached from their perspective when exploring phenomena but should collaborate with participants to explore and develop an understanding of the phenomenon being studied (Koch et al., 2015). I collaborated with participants through conversations during their interviews and ongoing discussions through reflective writing until the interpretation fully captured their lived experience. During this process, I learned the students' meanings about participating in a STEM program before college.

To avoid a conflict of interest, I selected participants with no direct relationship with me because this could have introduced bias in the study. Fontes (1998) suggested that a common theme in qualitative research is that the researcher has power over the participant within the relationship dynamics. I created a welcoming and nonthreatening environment conducive to the participants sharing their personal experiences and beliefs. I took on an informal antiauthoritative approach and established an atmosphere of power equality.

Reflexivity is the process in which researchers are conscious of and reflective about how their questions, methods, and knowledge of the subject may impact the data produced in a study (Creswell, 1998). In hermeneutic phenomenology, reflexivity is valued and essential because prior experiences aid in data analysis and interpretation (Parsons, 2010). Reflexivity helped me interpret the meanings discovered and added value to my understanding of the meanings. During the research process, preunderstandings and knowledge of the topic were brought into my consciousness and assisted me with analysis and interpretation, resulting in new meanings. I carefully examined and reflected on my preunderstandings of the phenomenon under study.

Using a reflexive journal helped me to document personal reactions, reflections, and insights before and throughout the study. My preunderstanding included my previous work in higher education as an academic advisor who worked with STEM majors. During my last years of academic advising, I worked at a Historically Black College and University (HBCU). I worked with biology, premed, and chemistry majors who were predominately African American. My basic understanding of and experiences with this population sparked an interest in obtaining a more in-depth understanding of how students experience STEM before collegiate programs. I also explored whether those experiences influenced students' decisions to pursue a STEM major in college. My preunderstandings also came from living in a rural community and witnessing the limited number of programs and resources available to youths.

Methodology

Participant Selection Logic

Purposive sampling for data collection allows the researcher to identify and select participants related to the phenomenon of interest (Denieffe, 2020). In purposive sampling, the researcher thinks about establishing a sample population because these individuals fit the characteristics of the people they need to reach (Ames et al., 2019). A homogenous purposive sampling technique identified participants with shared characteristics: first-year African American students from rural communities who participated in STEM programs before college and were pursuing a STEM major. To gain an in-depth understanding of the phenomenon of interest, I recruited enough students to gain insight into the topic and establish credibility (see Creswell, 1998). Researchers have suggested sample sizes for phenomenological research. According to Mthuli et al. (2021), a sample size of between six and 20 individuals is sufficient. I used a sample size of eight participants.

Inclusion criteria were established to identify participants who met the population requirements I sought to study. The inclusion criteria specified standard criteria for all participants with shared experiences. I also created exclusion criteria which consisted of potential participants who met the inclusion criteria; however, participants presented with additional characteristics that could have deviated from the purpose of the study (see Patino & Ferreira, 2018). An example of this would be that the student participated in a STEM program but resided in a suburban community. All students who contacted me to expressed interest in participating met the inclusion criteria before I sent the consent form and scheduled the interview.

Instrumentation

I conducted semistructured interviews with an interview guide (see Appendix) and a writing pad to capture my thoughts during and after each interview. The interview questions were developed so that participants could describe their unique experiences. To maintain self-awareness, I used a reflexive journal to note preunderstandings about STEM students, programs, and rural communities before and throughout the process (see

Karagiozis, 2018). Zoom, an online communication platform, was used to conduct and record the interviews. In recent years, Zoom has been used more frequently to collect qualitative data. Zoom has been recognized for its relative ease of use, researchers' ability to record and store sessions without recourse to third-party software, cost-effectiveness, and transcribing capabilities (Archibald et al., 2019). I recorded participants' responses with their permission to capture their precise words.

Procedures for Recruitment, Participation, and Data Collection

Due to the ethical challenges researchers might encounter, the institutional review board (IRB) oversees research processes, including training graduate students in qualitative research skills (Ravitch & Carl, 2019). Researchers can always consult the IRB for guidance and work with them to come to mutually agreeable solutions to protect the participants and the integrity of the research process (Sanjari et al., 2014). Before recruiting participants, I received approval from the IRB at Walden University to interview the population of interest. I complied with IRB standards and guidelines (Approval Number 02-21-22-037142).

Recruitment

Following IRB approval, I sent students a flyer about the study on social media platforms. I was the only person in this study collecting the data. Recruitment of participants occurred for several months in a variety of ways. I sent a flyer to college students via Instagram, Facebook, and LinkedIn via a direct message. I also posted the flyer on my social media platforms. I also emailed colleges, universities, and local community programs (TRIO Upward Bound) in Florida to request assistance in disseminating the flyer and posting it in visible places where students spend time.

Participation

In this study, eight first-year students were invited to participate based on their interest in the research and met specifications in the inclusion criteria. The participants were first-year college students from rural communities who participated in a STEM program before college. Additionally, all the students who participated were pursuing STEM majors. The sample size was large enough to sufficiently describe my phenomenon of interest and address the research questions (see Moser & Korstjens, 2017). Creswell asserted (1998) in qualitative studies, the sample size depends on several factors, including the participants' narratives, the richness of data, and saturation. If the student expressed interest in participating in the study, they sent me an email to express their interest. Upon receiving the students' interest email, I sent a consent form to the student to complete. The interviews were scheduled upon receiving consent from the participants. Students were advised that they were free to withdraw at any point in the study. Participants were sent a gift card following the interview to compensate them for their time.

Data Collection

Interviewing allows researchers to explore perceptions, subjective experiences, beliefs, and individual motivations. Moustakas (1994) posited that interviews enable the researcher to discover what is in someone else's mind, underscoring the importance of focusing on the perception of the lived experience. In a phenomenological study, the researcher utilizes a combination of techniques, such as conducting interviews, reading documents, watching videos, or visiting places and events, to understand the meaning participants' place on whatever is being examined (Creswell, 1998). Interviews are characterized by the method that they are structured, which include questionnaires, open conversations, or autobiographical, semi-structured (Husband, 2020; Ngozwana, 2018). Semistructured interviews were used to collect data and capture rich details about the students’ experiences in a STEM program. According to Jones and Donmoyer (2020), face-to-face interviews allow researchers to assess body language, indicating a level of discomfort with questions. All interviews were conducted via Zoom. If the camera feature was not turned on upon a student entering the Zoom call, I asked them to turn it on if they were comfortable.

The interviews began with a brief introduction about the purpose of the study. Following the introduction, participants were asked questions from the interview guide. Interview questions were focused on gaining a richer and deeper understanding of how the participants experienced the STEM program. Follow-up questions were asked when I needed participants to elaborate or clarify a response. Following the interview questions, I accepted questions and additional comments. I advised students that they would be contacted to review their transcript to verify that I accurately captured the information that they shared. Participants were sent transcripts, interpretations, and emerging themes to ensure the captured information reflected their stories.

Data Analysis Plan

The goal of data analysis from a hermeneutic phenomenological perspective is interpretive. I sought to interpret and develop a deeper understanding of a phenomenon (Peoples, 2020). I approached the data analysis to focus on uncovering the rich experiences of students engaging the data interpretively through semi-structured interviews, verbatim transcripts, reflection journals, notes, and utilization of the hermeneutic circle. I acknowledged my preunderstandings and biases before interpreting the data in a reflexivity journal. My previous experience working with STEM students and residing in a rural community established a baseline of pre-understandings about the phenomena; these pre-understandings were examined during the data analysis. I initially planned to use computer software for data analysis; however, I decided to manually analyze the data to immerse myself fully in the text and understand the students' experiences more deeply (see Creswell, 1998; Denzin & Lincoln, 2018). Data were organized using Microsoft Word and Excel. Using Microsoft Word, I combined the participants' responses to review the transcript as a whole. After reading the transcript, I used Microsoft Excel to organize the data to explore the text in parts. I created columns for codes, memo notes, participants' quotes, and themes.

Heidegger did not provide an analysis method for hermeneutic phenomenology research. Laverty (2003) posited that understanding occurs through a fusion of horizons, a dialectic between the preunderstandings of the research process, the interpretive framework, and the sources of information. Gadamer (2004) emphasized that the application of the hermeneutic circle, use of imagination, and attention to language and texts are vital aspects of the data analysis. I used the hermeneutic circle to examine how the participants' shared experiences fell within my preunderstanding and PVEST model. The data analysis process in a hermeneutic qualitative study is not bound to a single set of analytic techniques, so I used the hermeneutic circle and the process of understanding with the interplay of multiple analyses activities to analyze the data (Peoples, 2020). Figure 3 illustrates the general data analysis flow chart that consisted of the steps taken to complete the analysis, which was as follows:

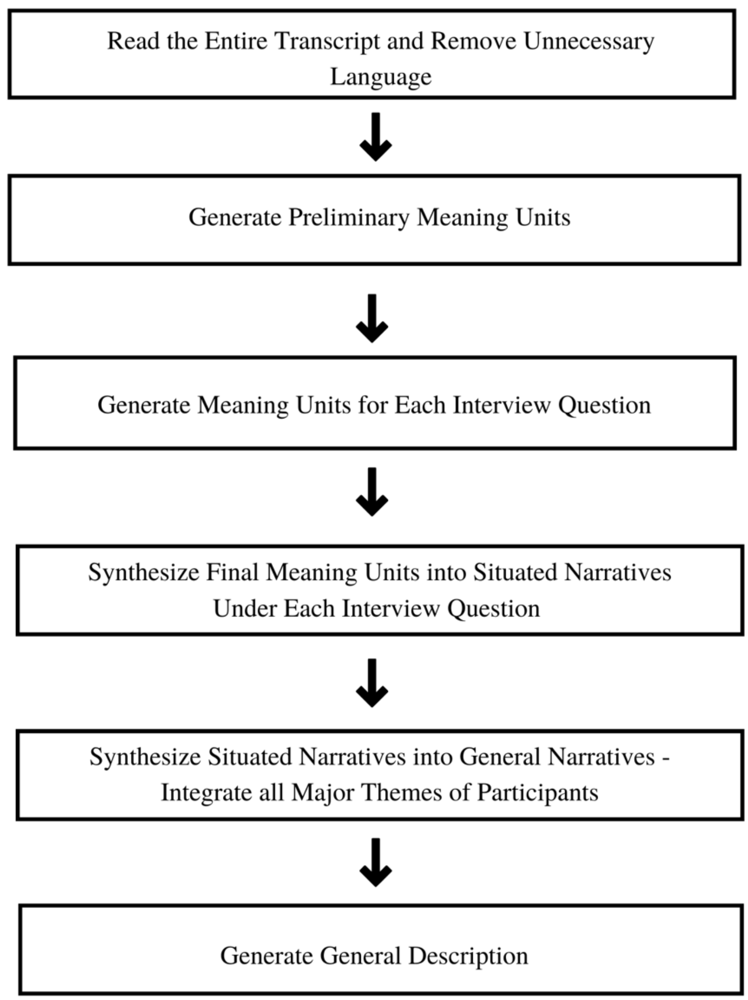
1. Reading and revisions – I immersed myself in the data by reading through the whole transcript multiple times before exploring parts to develop a preliminary interpretation of the text. This comprehensive understanding was referenced and used as the foundation for a deeper examination of the parts (see Gadamer, 1977). I also cleaned up the transcripts removing asides, "ums," and repeated words.
2. Create a preliminary meaning unit – The first-round open coding generated meaning units. Meaning units in phenomenological studies are descriptions generated by identifying common traits of the phenomenon (Giorgi, 1997). This was initially done using a color-coding system on Microsoft Word.
3. Final meaning units – Preliminary meaning units were broken into final meaning units (also known as themes). I created final meaning units following a deep understanding of the students' descriptions of experiences.
4. Develop situated narratives – Using a Microsoft Excel spreadsheet, I thematically organized the final meanings units of students' specific

experiences under the specific interview questions. The students' responses were ideas expressed in their own words and used to create situated narratives.

5. Create general narrative – Developed from the situated narratives, I organized the data from the situated narratives representing the students' accounts and meanings of experiences to create a general description.
6. Create a general description – In the final step of the analysis, I created a general description comprised of themes implicit in all or most of the participants' descriptions of their experiences.

Figure 3

General Data Analysis Steps (Peoples, 2020)



Trustworthiness

Research should be understood and recognized as legitimate by researchers, policymakers, practitioners, educators, and the public. In qualitative research, rigor describes the creation of trustworthiness between the researcher, participants, and research reader (Creswell, 1998). Hermeneutic analysis fosters trustworthiness through the hermeneutic circle, interview questions and answers, and fusion of horizons making the analytic process comprehensible to the reader (Polkinghorne, 1989). The ultimate goal of rigor is ensuring that the information presented by the researcher's interpretation represents the participants' lived experiences. The trustworthiness of qualitative research depends primarily on what the researcher observes and whether the findings can be trusted (Jones & Donmoyer, 2021; Korstjens & Moser, 2017). Trustworthiness in this current followed the criteria developed by Lincoln and Guba (1985). These criteria include credibility, transferability, dependability, and confirmability.

Member-checking is a technique that researchers can use to establish credibility (Ravitch & Carl, 2019). Member-checking allows participants to clarify and confirm their intentions and provide additional information. According to Creswell (1998), member-checking strengthens the data by allowing the respondents to determine if the findings reflect their experiences. To establish credibility in this study, participants were emailed emerging themes and key points from transcripts for feedback.

Providing a thick description of the process during the interviews is the method chosen for transferability. According to Lincoln and Guba (1985), providing thick descriptions gives readers a proper understanding of the research process, allowing them to compare the instances of the phenomenon described in the research report with those they have seen emerge in their situations. In this study, I provided a rich account of descriptive data related to the research context, the setting, sample strategy and size, demographic characteristics, inclusion and exclusion criteria, interview procedure and guide, and excerpts from the transcripts.

Dependendibility in qualitative research relates to the consistency and reliability of the research findings and the extent to which research procedures are documented, allowing a future researcher to follow, audit, and critique the research process (Korstjens & Moser, 2018). As the research is underway and learning unfolds, the researcher provides an account of any changes that deviate from the original plan and design (Lincoln & Guba 1985). In this study, I transparently described the research steps and the path taken at the beginning and throughout the study. I compiled notes about the decisions made during the research process to include reflective thoughts and the emergence of findings to enable readers to study the transparency of the study.

Carefully assessing bias is one of the ways to establish confirmability because it ensures that the researcher interprets what the data suggests in an unbiased way (Karagiozis, 2018). Reflexivity helped me establish confirmability because I was self-aware of my role in collecting, analyzing, and interpreting the data (see Ravitch & Carl, 2019). Bringing pre-conceived assumptions is essential to the research process. In a hermeneutic approach, my preunderstanding contributed to interpreting the students' experiences (see Polkinghorne 1989). I used my reflection journal to document my subjective responses about the setting, process, and relationship with the participants (see Ravitch & Carl, 2019).

Ethical Procedures

Qualitative researchers explore participants' experiences in great depth and on topics that may be very personal due to the focus on individuals' perceptions of the study topic. Sanjari et al. (2014) suggested that ethical challenges may be present in the (a) research-participant relationships, (b) informed consent processes, (c) privacy and confidentiality obligations, and (d) data storage and management practices. Any research that involves people requires an awareness of the ethical issues that might arise. Ethical challenges arise when the research-participant relationship provides qualitative research data and leads to some degree of therapeutic interaction for the participant (Ravitch & Carl, 2019; Sanjari et al., 2014).

According to Ravitch and Carl (2019), potential ethical conflicts may exist based on the researcher's method of gaining access and their effects on participants. A balanced research relationship can encourage disclosure, trust, and awareness of potential issues (Sanjari et al., 2014). Karagiozis (2018) considered an interview a moral endeavor, and the knowledge gained affects our understanding of the human experience. I ensured that ethics remained a top priority during this study. The methods outlined in this chapter were followed and confirmed the validity and reliability of this study. Before the interviews, I explained this study's process, expectations, and purpose to each participant. The risks to human subjects associated with this study were low because the participants were 18 or older and provided consent to be interviewed without coercion. The participants selected did not demonstrate any impaired mental capacity as determined by self-report regarding their capabilities. Recorded interviews will be deleted after five years, following the final approval of research committee members, thereby minimizing potential risks related to confidentiality.

Summary

This chapter outlined the research design rationale, methodology, and theoretical framework for this hermeneutic qualitative phenomenological study. The data collection, study participants, semistructured interviews, and data analysis plan were also highlighted. Methods taken to ensure trustworthiness were highlighted, followed by ethical procedures outlined in the IRB guidelines. Chapter four provides participants' demographics, the setting of the study, the data collection procedures, the study results, and an explanation of the findings. To present my findings in Chapter 4, applicable participants' quotes from each theme will be included.

Chapter 4: Results

In this hermeneutic qualitative phenomenological study, I explored the experiences of eight African American first-year college students from rural communities who participated in a STEM-focused program before college. This study allowed me to understand the lived experiences of African American first-year college students from rural communities and whether those experiences influenced their decision to pursue a STEM major in college. The research questions addressed in the study were the following: What are the lived experiences of African American first-year college students from a rural community in a STEM-focused program? How did the experiences influence their decision to pursue a STEM major in college? This chapter covers the setting, participant demographics, data collection, data analysis, evidence of trustworthiness, and results.

Setting

The setting for this current study took place online via Zoom. All participants had access to Zoom and were visible via the camera function. The participants stated that they had privacy in the setting they were in during the interview. I conducted the Zoom interview in a quiet office space. Participants confirmed that they understood the study's purpose and felt comfortable answering the questions. The participants were reminded that the interview would be recorded and kept confidential.

Demographics

Of the eight participants, two were men and six were women, ages 18 and 19. Table 1 provides data on the characteristics of the participants interviewed according to gender, age, and current college major. All participants had a shared background of having resided in or currently living in a rural community before attending college, having participated in a STEM program, and pursuing a STEM major. Each participant lived in the state of Florida.

Table 1

Participant Demographics

Participant	Gender	Age	Major
Participant 1	Male	18	Molecular cellular biology
Participant 2	Female	18	Pre-pharmacy
Participant 3	Female	19	Biology pre-medicine
Participant 4	Female	19	Pharmacy
Participant 5	Female	18	Pre-physical therapy
Participant 6	Male	19	Computer information systems
Participant 7	Female	18	Chemistry
Participant 8	Female	18	Biology pre medicine

Data Collection

As indicated in Chapter 3 and following IRB approval, I posted and sent a flyer directly to students via Instagram, Facebook, and LinkedIn to recruit participants. I also emailed colleges, universities, and local community programs (TRIO Upward Bound) in Florida to request assistance from these organizations to post the flyer in visible places for students. Students who expressed interest and met the inclusion criteria completed a consent form. The flyer and consent form included the study's objectives, benefits/risks, and the time needed to complete the interview. Once responses of interest and consent forms were received from the participants, I scheduled interviews via Zoom. I reminded participants 1 day before their scheduled interview to confirm attendance.

Each participant completed a semistructured interview that lasted 45–60 minutes via Zoom. Data collection for the interview focused on the student's experiences in the STEM-focused program and how those experiences influenced their decision to pursue a STEM major in college. These interviews were semistructured and included questions encouraging students to share their experiences in the STEM program (e.g., "describe in detail your STEM program experience" and "tell me about your experience learning about college majors while participating in the program"). I also asked questions related to PVEST (e.g., "describe your perception of the program leaders in the STEM program" and "describe the perception you had of yourself as a participant in the program").

The interviews were recorded and transcribed via Zoom transcription. I cleaned up the transcription and removed "ums" and "uhs." Words were not altered because it was essential to maintain the intent and emphasis of the interviewee. The participants were sent written transcripts via email to ensure that the information captured was adequately represented in written format. Initially, participation in this study did not include compensation. However, I included an incentive to increase participation due to the low participant interest. I submitted an update to the IRB, which indicated offering a $10 Visa gift card to those who met online to participate in the study. The gift card was a way to show appreciation for completing the interview. I advised the participants that they would receive gift cards if they decided to withdraw after completing the interview.

Data Analysis

Eight African American students from rural communities who participated in a STEM program before college were interviewed for this study. The students shared essential experiences of how they understood themselves and others around them in the program, the process of deciding to pursue a STEM major in college, and the support they identified as essential to their experience. A hermeneutic phenomenological approach was used to obtain a deeper understanding of the phenomenon (see Parsons, 2010). A phenomenological hermeneutic method was well suited to reveal, understand, and interpret the meaning students made of their experiences in a STEM program. The PVEST lens was used to analyze and interpret the emerging themes. PVEST is a framework that deals with the relationship between an individual's view of the world and the historical, social, and cultural forces that impact their development (Spencer, 2006). PVEST is a culturally responsive framework to Bronfenbrenner's EST that includes the phenomenological interpretations and responses of youth behaviors and outcomes (Velez & Spencer, 2018).

I examined my experiences working with African American STEM students and my prejudgments about rural communities' scarcity of resources. According to Heidegger (1982), people engage in and interpret the world. I used my personal experiences and background during the process of interpretation. I noted that most students became interested in STEM during middle school while journaling. I also journaled that most of the students stated they were one of the few African Americans who were in the programs. Three students mentioned their need to be in culturally diverse environments as one of the reasons for deciding to attend an HBCU, which was also documented in my journal.

PVEST was used as an additional lens to understand how the meaning-making process is created through students' perceptions and constructed realities, specifically how they understood and responded to their experiences. I evaluated students' experiences based on the components Spencer (2006) used to explain identity formation. This evaluation occurred after I coded the raw data and identified the final themes. I began determining whether these themes impacted student experiences regarding their identity, perceptions, supports, coping skills, worldview, and beliefs (see Spencer et al., 1997). I identified how students created meaning based on their experiences and how that meaning impacted their decision to pursue a STEM major in college.

I did not use data analysis software. Instead, I became fully immersed in the students' experiences, reading the transcripts before exploring parts, carefully dwelling, and attending to the interactions between the parts and the whole (see Gadamer, 2004). I cleaned up the text by removing asides, repetitive statements, and verbalisms such as "um," "uh," and "well." During this process, I organized the transcripts and memo notes while describing the context and emotions that were not captured by the recording using Microsoft Word. Gadamer (2004) suggested that understanding the whole transcript will impact understanding every other part of the text. Codes and themes emerge when the text is understood in parts (Manen, 1992). I examined the interrelationships among the parts while comparing those interrelationships with the whole. This allowed me to think about what the students said and meant during the interviews.

Next, I used open coding to create preliminary meaning units. This initial coding was done using a color-coding technique within an Excel spreadsheet, highlighting the statements that appeared to reveal the topic under consideration. Parsons (2010) referred to this process as the preliminary interpretation of text whereby the researcher explores parts of the text compared to the whole to facilitate open coding. I maintained an open mind while reading through the data and my journal notes. I created a column for the first-round codes, highlighting key phrases for the preliminary meaning units. Some examples of the initial codes included “hands-on projects,” “building robotics,” “MathLab,” and “water filters.”

Third, the preliminary meaning units were developed from phrases of each participant’s experience that were broken down into final meaning units (themes). This deepened my understanding of each student’s experience. I maintained a continual attentiveness to transforming my understanding of the phenomenon while creating final meaning units. For example, the initial preliminary meaning units identified in Step 2 were synthesized into the theme of experiential projects and represented a significant part of the STEM program experience.

Using an Excel spreadsheet, I created two columns. One column was for the final themes, and the other was for participants’ direct quotes. I reviewed each transcript again and highlighted salient participant quotes that helped describe the themes. This created situated narratives and served as a reiteration of the students’ stories. The situated narratives formed general narratives that contained the major themes identified in all or most interviews. The synthesis of experiences created a general description of the students' meanings of their experiences. For example, when participants described their experiences in the STEM program, they expressed that they valued and benefited from the experiential projects. Each participant shared a different project; however, all recalled the projects being an exciting part of their experience. Finally, I created a general description of implicit themes identified in most students' descriptions of their experiences. The goal was to connect the themes that emerged to research questions, creating a cohesive description of the phenomenon (see Table 2).

Table 2

Themes and Corresponding Preliminary Meaning Units

Theme	Meaning unit
Experiential projects	Projects, experiments, coding, presentations
Sources of support	Mom, family, friends, great teacher, willing to help, involved, supportive
Early exposure	Research, middle school, college tour, new experiences, dual enrollment
Lack of diversity	Predominately White, skin color, few African Americans, relate
Self-perception	Hard worker, resilient, positive mindset
Networking opportunities	Hospital, shadowing, other students, small town
Disconnect between college expectations and preparedness	Missing assignments, high school was easier, challenging, lack of time management, tough, procrastination

Evidence of Trustworthiness

Credibility

This study established credibility because the findings represented the information gathered from the participants' original views (see Korstjens & Moser, 2018). Lincoln and Guba (1985) suggested that credibility can be established through reflexivity, triangulation, prolonged engagement, and member checking. Hermeneutics establishes credibility through rich textual descriptions of the participants' experiences and their original data (Korstjens & Moser, 2018). The current findings were confirmed by the participants, who provided their perspectives through member checking. Member checking is a strategy to verify the accuracy of the researchers' thick descriptions and interpretation of the participant's lived experience (Creswell, 1998). Current participants confirmed that the transcripts, interpretations, and emerging themes reflected the meaning of their experiences in the STEM program. This process allowed me to learn the meaning students held about participating in the program, not the meaning I brought to the study. Credibility was also established through my prolonged involvement with the raw data (see Lincoln & Guba, 1985). I repeatedly listened to the interviews, transcribed them to become familiar with the texts, and got immersed in the data through hand coding.

Dependability

Because the philosophical stance of hermeneutics underpinned this study, it is impossible to repeat this study with the same participants and expect consistent findings because researchers' and participants' horizons are subject to change over time (see Gadamer, 2004). Dependability was established by consistently aligning the research process with the hermeneutic design. I clearly outlined the methodological practices and procedures for selecting the participants and analyzing data to promote consistency (see Crowther et al., 2016). Using the hermeneutic circle, the fusion of horizons and interpretations further established dependability in this study.

Transferability

Thick descriptions of the data were provided and carried out in this study. Transferability, also known as applicability, is established by how well the research findings describe the context and its influence on a studied phenomenon (Luba & Guba, 1985). Results in this study were conveyed using thick descriptions to strengthen transferability. I provided extensive and detailed information about the interview settings, sample size, participant demographics, and majors. I also clearly stated the inclusion and exclusion criteria established for the study participants. The thick context descriptions should allow other researchers and readers to make transferability judgments surrounding this study.

Confirmability

I refrained from holding an objective position about the subject because my preunderstandings were a part of the data. In hermeneutic research, researchers disclose their preunderstandings, experiences, and ideas (Laverty, 2003). Reflexive notes included thoughts about my subjective responses, assumptions, and previous experiences. I evaluated the emerging explanations of texts when faced with conflicting or divergent interpretations to ensure that other uncultivated preconceptions did not influence the quality of the data analysis and findings.

Results

Each student presented a unique experience infused with perceptions about themselves as participants, perceptions of their peers and program leaders, their contexts at the time, and the decision to pursue a STEM major in college. In-depth conversations yielded the following essential themes among participants' (a) experiential learning projects, (b) networking opportunities, (c) lack of diversity, (d) self-perception, (e) sources of support, (f) disconnect between college expectations and student preparedness, and (g) early exposure. A discussion of each theme, organized by the research question it addressed, will be supported by quotations of participants' exact words extracted from the interview transcripts. The first research question addressed in this study was what are the lived experiences of African American first-year college students from a rural community in a STEM program?

Theme 1: Experiential Learning Projects

When discussing their experiences, multiple participants referred to experiential learning projects as a positive experience in the STEM program. These opportunities included science projects, lab experiments, coding, building robots, and learning new technology software. Students stated that the projects were "interesting" and a favorite part of the experience. Researchers have confirmed that exposure to experiential learning opportunities can increase a student's interest in STEM-focused careers (Hughes et al., 2021; Mau & Li, 2018; Mtika, 2019). Hands-on projects help students think of themselves as science learners making the experience meaningful (Tal, 2021). Participant 5 stated that the program's experiential learning projects helped her earn credentials: "I earned my certified medical advising assistant certification, CMAA, and electrocardiograph certification, which is my EKG. I'm EKG certified. And then my certified medical assistant certification, which is a CMA." Participant 5 stated that the program positioned her to get a job in the future. Participant 5 stated, "we went to a local college called Indian River State College. They let us tour their facility because we were in this program and were all offered jobs as CNAs, CMAs, and EKGs once we graduated."

Motivating students to address and solve real-world problems teaches them new skills that can be put into practice and help to develop critical perspectives and knowledge that they can apply throughout their lives (Pino-Juste et al., 2020). Participant 2 said she engaged in projects that opened her mind to unfamiliar STEM careers.

> We were doing the infiltration project to help people in rural areas get clean water. Because, you know that, in different areas of the world, people don't have access to clean water; however, by making these little portable filters, we could help people get more water.

Although participants in this study were all African Americans from rural communities, each participant was in different STEM programs before college. All participants talked about hands-on activities being the highlight of the program. They were particularly interested in the activities that exposed them to a new skill or unfamiliar aspect of STEM. Participant 1 talked about how building robots was an experience she never imagined enjoying because of her interest in becoming a doctor. Participant 2 shared her experience learning how to build a rollercoaster, which was meaningful because she enjoyed riding them at amusement parks. She stated: "the only thing I can remember clearly is the field trip we took. We helped make a rollercoaster. We also learned about the types of kinetic energies used for rollercoasters."

Theme 2: Networking Opportunities

Among the participants' shared experiences, networking opportunities were often described as a positive aspect of the program and were found in most responses. For students residing in rural communities, networking can help them connect with leaders in their desired fields, develop their skills, and lead to future opportunities (Sheffield et al., 2018). Most students talked about their positive experiences networking with STEM professionals, college reps, and students from other communities interested in pursuing a STEM career. Participant 3 stated that she met another student in the program whom she described as “friendly” and “helpful” and had been exposed to STEM programs for several years. Although participant 3 was exposed to STEM-related activities before participating in the program, she never participated in one offered on a college campus. Networking with a peer was beneficial because she received tips and advice from someone who had prior experience navigating a college campus.

Participant 8 shared his experiences networking and working with a physics professor during his program participation at the University of Northern Iowa. Participant 8 learned how to use MATLAB, a programming and numeric computing platform STEM professionals use to analyze data with the help of the physics professor. Participant 8 stated that he worked with Raspberry Pi, a series of small single-board computers, and configured a robot for emotional management. Participant 8 stated that learning MATHLAB and accessing resources such as Microsoft Office and Adobe products was a valuable part of the experience. By the end of the program, Participant 8 stated, “I learned coding, coding languages like C++ and Java software, and I presented a project at a national conference with the physics professor."

Theme 3: Lack of Diversity

Participants recalled their experiences with the program lacking diversity. They recounted situations where they were among the few African Americans in the program. Although participants shared this experience, they were impacted differently. Singer et al. (2020) emphasized the importance of educators creating enhanced academic experiences for students of color. Williams and Moody (2019) suggested that educators learn about subtle microaggressions, create acceptance environments, and foster healthy communication to improve interactions with African American students in predominately white academic settings. Participant 5 stated that she experienced stereotyping, microaggressions and perceived program leaders as being "doubtful" about her skills. Participant 5 shared a specific example of when she was stereotyped by a program leader in front of her peers.

> Sometimes, they related things to me that weren't true regarding health, statistics, and so on. I remember one lecture where we were learning about statistics related to socioeconomics, family structure, and social classes. One of the statistics was about family households and individuals raised in a single-parent home. The leader related that to me and implied that I was probably raised in a household with an absent father. My dad is very active in my life. He's been there since I was born. So that was one of the things that stood out to me.

Participant 4 stated that although she was among the few African Americans in the program, she did not feel discriminated against while participating in the STEM program. However, Participant 4 described feeling nervous at the program's start because there weren't many African American students.

> I was intimated by there not being more African American students in the program to represent us and wondered why there were more of us there. However, I realized that I couldn't go into situations thinking negatively or being afraid. It was a good experience overall.

Participant 3 believed that being one of the only African Americans in the program motivated her to "work harder." She witnessed some of her African American peers experience challenges in the program. Participant 3 also shared during the interview that some African American students in her community had difficulty getting into the program.

> I heard some of them complain about getting into the program. I hate to say this, but it was predominately White, and they didn't want the African American kids to get ahead. Some students did not know about taking the SAT ahead of time as part of a requirement. They did not receive help with the process.

Theme 4: Self-Perception

Participants shared how they perceived themselves as participants in the program. Although most participants shared that they were initially nervous at the program's inception, most of the participants viewed themselves positively. Self-perception in this study refers to students' views about themselves, their characteristics, and the judgments they made about the traits they possessed (Mohebi & Bailey, 2020). Participant 5 stated, "my parents taught me to embrace who I am and embrace the skin I'm in." Although Participant 5 experienced microaggressions and received harsher dress code "write-ups" than White program participants, she learned to "take it with a grain of salt." Participant 5 stated that being one of the only African Americans in the program pushed her to persevere and made her stronger.

> I'm strong. I can deal with a lot. It takes a lot to get me mad. I learned that I could overcome so much. I learned a lot about my study habits, how I learn, and how I'm more of a hands-on learner. I learned to embrace being, you know, one of the only African Americans in the room.

Participant 6 stated that program facilitators played a role in how he perceived himself in the program, which he believed "was more for me than others the other students." Participant 6 stated that program facilitators described him as a "good fit" for STEM and that his future in the field is promising. Participant 7 perceived herself as a "hard worker" and "active learner," and her facilitator validated her perception.

> One day, the program leader used me as an example for the class and asked me to go up to the front of the classroom to help facilitate that day because I explained a topic well. I kept it in my head because I didn't always have a forte for Chemistry.

Theme 5: Disconnect Between College Expectations and Preparedness

Although participants shared positive and beneficial experiences in the program, participants also stated that they discovered a disconnect between college expectations and preparedness. Participants' responses aligned with the research that has found that many African American first-year college majors do not possess the fundamental skills, STEM attitudes, and behaviors essential to their academic success (Lane et al., 2017; Stipanovic & Woo, 2017; Verdin et al., 2018). Participants believed that because they participated in the program during high school, it was essential to learn more about college expectations beyond the campus tours. Participant 1 referred to herself as a "procrastinator," as she described her first year in college. Participant 1 shared challenges with submitting work on time. Participant 7 stated that she had to "adjust" to her professors' teaching style once she got to college. Participant 7 discovered that time management was challenging as a first-year STEM major. "I had to learn how to manage my time because I was falling behind in one of my classes."

Participant 8 experienced academic challenges during his first semester as a STEM major.

> I had a rocky start as a freshman, whether it was missing assignments or just needing to know more. Following my first semester, my GPA fell below 2.0. My motivation waivered. As a freshman, I had to get used to the new environment because when I was in high school, more than half the time, my teachers were lenient. I had much time to prepare for upcoming assignments. I realized I had to create a schedule because the professors would not do it for me.

Participant 3 expressed similar experiences regarding flexibility in high school related to submitting assignments on time.

> High school teachers give you multiple opportunities to turn in late work. Being in college, I learned that my teachers don't make the same exceptions. I missed a

> few assignments at the beginning. Once I got used to it, I knew I could not procrastinate. So, I started working on my assignments early to submit them on time.

The second research question addressed in this study related to how the students' experiences influenced their decision to pursue a STEM major in college.

Theme 6: Sources of Support

Subtheme: Parents and Family

In this study, participants identified someone who served as positive support during their experience in the program. According to Reid-Griffin (2019), students need to feel connected and supported as they learn and engage in STEM-related opportunities. Although all the participants talked about the support they received in the STEM program, seven participants highlighted that a parent played a significant role. Participant 1 said: "My mom was hands-on with anything I needed. 100% super supportive." Parent involvement fostered the students' participation in programs beyond the traditional school setting and their overall interest in STEM. Consistent references to parental involvement in this study support the notion that parents play a pivotal role in supporting their children's STEM interests (see Hans, 2017). As the participants shared their experiences with receiving support from a parent, some specifically talked about their parents' confidence in their capabilities. This appeared to have contributed to their interest in pursuing STEM despite the obstacles they may have encountered. Participant 8 stated, "my family was mostly relaxed about me being there. They had faith in me, for the most part, and knew I had my head on straight and would focus on getting the job done."

Most of the participants in this study stated that they did not feel pressure from their families to pursue STEM despite others members of the family who worked in the field. Participant 4 perceived having the autonomy to choose a major based on her interests.

> My mom doesn't like to force things on me. She told me not to get into the medical field because it's something that she wants me to do. She wants me to pursue the field because it is something I want to do for me. I have a choice and can live my own experiences. So, when I knew I was interested in STEM, I brought it to my mom's attention, and she thought it was a great idea.

Subtheme: Program Leaders

Throughout the interviews, most students spoke about receiving support from the program leaders. Participants described the program leaders as "knowledgeable," "supportive," "amazing," and "dedicated." Participant 1 stated that her experience with the program leader was "phenomenal."

> The teacher went above and beyond for the kids. She planned trips and activities. We went to Gainesville to tour the University of Florida's chemistry lab. She was very much for her students. She took us on many college tours. I enjoyed the tours the most.

Participants referenced their program leaders, affirming their abilities, and highlighted this as a positive part of the experience. They believed that the program leader perceived them as "good students." Participant 3 stated that she thinks the program leader wrote her a recommendation letter for college because she was "perceived" as a good student. Participant 6 noted that the program leaders were "very vocal" about his skills and abilities in science. Participant 6 stated, "when it came to me, they told me that they see me doing more in science in the future."

Despite most students describing their program leaders as positive, Participant 5 experienced a negative occurrence with the program leader. Participant 5 perceived that she and her African American peers were treated differently than the White students. Participant 5 recounted experiences of microaggressions that caused her to feel uncomfortable. Researchers have found that African American girls in the U.S. are at risk of race, class, and gender exclusion in predominately white academic settings (Toldson et al., 2020; Wade-Jaimes et al., 2019; Williams & Moody, 2019). Participant 5 shared an experience where the program leader wrote her up for being "out of dress code." Participant 5 stated that she and her minority counterparts were accused of dressing inappropriately because their uniforms fit "a bit differently."

> Many of my minority counterparts, African American females, got written up a couple of times because we were out of the dress code because of how our uniforms fit. They only allowed us to get certain scrubs, which didn't work. You know how uniforms fit people differently. Yeah, it just wasn't good. My parents got me new scrubs that were loose-fitting. I didn't like it, but I had to get my hours to sit for the certification I wanted, so I had to do it.

Although Participant 5 considered issues with uniform compliance a negative experience, she learned how to overcome challenging situations. Participant 5 also stated that the few minorities in the program supported one another, substantiating the notion that friends are an essential source of student influence and support (see Vernon & Drane, 2020).

Theme 7: Early Exposure

Subtheme: Middle School

Another theme from the study was when participants shared their decision to pursue STEM as a career, specifically when participants were asked how their experiences in the program influenced their decision to pursue their current major. As the participants shared their experiences of deciding to pursue a STEM major, more than half of the students stated that they developed an interest in STEM as early as middle school. Each focused on a slightly different opportunity that provided early exposure, but it was apparent that most developed an interest in middle school. This theme supports the abundance of research that many students develop an interest in STEM during their formative educational years (King et al., 2018; Rodriguez, 2018; Sithole et al., 2017; Stringer et al., 2019). Although Participant 1 career goals changed over the years, her career interests remained in the realm of STEM. Participated 1 stated, “I’ve always known I would work in a STEM field since middle school. I went from wanting to become a cardiovascular surgeon to a neonatal surgeon to now an OBGYN.” Participant 2 shared, “I have wanted to pursue a STEM major since middle school, but I wasn’t sure exactly what field. I thought of aerospace engineering, but I’m pursuing pharmacy now.”

Participant 3 shared, "since middle school, my mom started signing me up for free classes in STEM. She always had me enroll." Participant 7 discussed developing an interest in STEM in middle school after seeing Full Sail University commercial advertisements. Nearing the end of the interview, Participant 7 remembered that his aunt, a university professor, talked to his mother about sending him to STEM summer camps when he was in middle school.

> I got to participate in many summer camps at a university campus when I was younger, so I was at least getting an idea of what it was like to be on a college campus. Many of the programs I participated in at the university during the summers were STEM-related.

Subtheme: Exposure to Parents' Career

Exposure to their parents' careers was another factor that influenced students' interest in STEM. Rodriguez (2018) found that parents who worked in STEM were positive models for their children making STEM-related career choices. Traditionally, "Take your Child to Work Day" was created for young people to learn and gain insight into the workplace, build self-esteem, and challenge gender stereotypes (Arceo et al., 2008). Many participants were exposed to learning more about STEM opportunities and work options because of exposure to their parent's profession and work setting. Students saw patients and witnessed a day in the life of their parents and other professionals in the field.

Participant 1 stated that she became interested in STEM because her mother is a phlebotomist. Participant 4 talked about the moments visiting her mother's office when she was younger and observed her taking care of patients.

> My mom has been in the medical field for a long time. I remember when she became a CNA, an LPN, and an RN. I was younger when she started. I was exposed to her at the hospital and remembered going to her job when I was younger and walking around the hospital. I was able to help her work with some of the patients, which made me more susceptible to being in that environment and the person I am today. I like helping people.

Participant 5's mother is a nurse practitioner, and her father is a physical therapist. Participant 5 parents were proactive about exposing her to their careers early. Participant 5 recounted "doing rounds" with her mother on the weekends. Participant 5 also talked about incurred injuries, including tearing her ACL during a high school basketball game. Following an ACL surgery, Participant 5 was advised to undergo physical therapy. She received treatment at a clinic where her father worked as a physical therapist. Although her father was not her physical therapist, Participant 5 was a patient with one of his colleagues who pushed her "beyond limits." Participant's 5 personal experiences in physical therapy sparked an interest in pursuing the major in college.

General Narrative

Students believed that STEM precollegiate programs were a valuable and positive experience. Students learned about the program from a family member or a school teacher. From students' perspectives, gaining entry into the program was not difficult.

However, programs were not in the students' local communities. Therefore, family members provided transportation or room and board if the program was in a different state.

Students found some of the program activities, such as experiential projects and networking opportunities, to be most beneficial. Most students perceived the program leaders as encouraging, knowledgeable, and dedicated sources of support. Although students found participation in the program helpful, most believed it did not prepare them for the rigor of STEM in college and needed more diversity. The lack of diversity was challenging for a few students; however, it did not negatively affect their decision to pursue a STEM major in college.

The unfamiliarity of college expectations presented a barrier for students during their first year; however, they eventually learned how to navigate challenges. Many students perceived there being a disconnect between college expectations and preparedness. Students believed receiving more information about college expectations would have been a beneficial component of their experience in the program. Most of the students discussed challenges in managing time and meeting deadlines. Over time, students learned different strategies to manage their time. However, time management skills were developed after they began missing assignments, negatively affecting their grades. Students discussed the flexibility and leniency they experienced in high school but learned that college required different standards.

Students discussed how and when their STEM interests developed. Most students' interest in STEM was identified in middle school and inspired by a family member.

Students were exposed to STEM by a family member who worked in a STEM profession, signed them up for STEM-related summer groups, or brought the student to their jobs. Students perceived their family members as supportive and responsible for nurturing their interests. Program leaders were influential in encouraging and affirming students' goals and academic abilities.

General Description

African American first-year college students from rural communities illustrated their unique experiences of participating in a STEM program before college. Both positive and negative experiences were revealed as the students shared the various benefits of the program. Students were familiar with STEM fields due to early exposure before participating in the STEM program. Experiential projects, networking opportunities, and affirming leaders were highlighted as the most impactful experiences in the program. Although participants shared positive experiences, many found the programs lacked African American representation.

Students discovered that expectations of majoring in STEM required an unfamiliar level of skills and discipline. Despite the challenges students faced during their first semester in college, they learned strategies that helped to them to navigate the academic rigor of STEM at the college level. Students would have pursued a STEM major regardless of participating in a STEM program. Although program participation was beneficial, it was not the sole influence of why students pursued a major in STEM. For most students, the program provided them with credentials and specialized skills they perceived as beneficial for the future.

Summary

Underpinned by Heidegger's interpretative phenomenology, the hermeneutical approach used for this current study allowed me to capture the experiences of eight African American first-year college students from rural communities in a STEM program. This hermeneutic phenomenological approach uncovered the meaning that each participant made within their individual experiences. The semistructured interviews provided rich data to support my ability to interpret the participants' experiences.

Throughout the data analysis process, my journal notes were compared with the text within the transcript to identify emergent themes. The emergent themes derived from the data revealed students' experiences in a STEM program. The findings were reported using direct quotations from the interview responses and interpreting through descriptions instead of explanations. I recorded key points in my journal during and after the interview, which assisted me in facilitating the analysis. This interpretation involves engaging preexisting data, experience, and perceptions with the phenomenon (Heidegger, 1994; Gadamer, 1977).

I engaged the hermeneutic circle by using my reflective journal to document notes and revise when new understandings occurred, thus forming a new interpretation (see Heidegger, 1982). The process of understanding, absorbing new information, interpreting, and creating a new understanding underscores the concept of the hermeneutic circle (Peoples, 2020). This iterative cycle of reading through the whole text and its parts continued until there was a complete understanding of the phenomena (see Peoples, 2020). The new knowledge expanded my horizon of understanding how students from rural communities experienced a STEM program. Moreover, how their experiences influenced their decision to pursue a STEM major in college.

The research questions in this hermeneutical qualitative study focused on exploring the lived experiences of African American first-year college students from rural communities in a STEM program and whether those experiences influenced their decision to pursue a STEM major in college. Findings revealed seven emergent themes, including experiential learning projects, sources of support, early exposure, networking opportunities, lack of diversity, self-perception, and disconnect between college expectations and student preparedness.

In Chapter 5, I further interpret the study findings and evaluate them with Spencer’s PVEST model. I will also discuss the study's limitations, implications, and recommendations for future research.

Chapter 5: Discussion, Conclusions, and Recommendations

The purpose of this hermeneutic qualitative phenomenological study was to understand the lived experiences of first-year college students from rural communities who participated in a STEM program. I also sought to identify whether the experiences influenced students' decisions to pursue a STEM major in college. Given the low matriculation of African American students from rural communities as STEM college majors, I explored how students experienced STEM programs because billions of federal dollars have been spent on program initiatives geared toward revitalizing STEM pipelines. The PVEST was used to understand the final themes and is explained in detail. Adding a PVEST framework was essential because it provided a lens to understand youths' experiences within their contexts. According to Spencer (2006), these context-specific experiences lead to belief systems and behaviors that develop over time.

Eight African American first-year college students from rural communities participated in this study. The research questions focused on the students' experiences participating in STEM programs and whether these experiences influenced their decision to pursue a STEM major. A hermeneutical approach was a philosophical underpinning to understanding students' lived experiences in the program. As a methodology, hermeneutics complimented the PVEST framework because both emphasized contexts and meaning-making experiences. This chapter presents a summary of findings, including applying the PVEST lens. Limitations of the study, recommendations, implications for future research, and a final conclusion are also included.

Interpretation of Findings

The findings of this study enhanced my understanding of the experiences of African American first-year college students from rural communities who participated in a STEM program. This study offers a new interpretation of the students' lives who have experienced a STEM pipeline program. Findings revealed that students believed participating in a STEM program before college was beneficial. However, participation in the program was not the only factor determining their decision to pursue a STEM major in college. After extensive analysis and reflection, seven main themes emerged in this study: experiential learning projects, sources of support, early exposure, networking opportunities, lack of diversity, self-perception, and disconnect between college expectations and student preparedness. These themes have been interpreted as what students found meaningful about their program experiences.

Theme 1: Experiential Learning Projects

In this study, students identified experiential projects as one of the program's valuable aspects. When students shared their experiences with experiential projects, they discussed hands-on projects that they found interesting and engaging. Students showed genuine interest in working kinesthetically with projects stimulating their creativity and curiosity. When students participated in experiential projects, they had the opportunity to expand their learning beyond the traditional classroom setting. Participant 2 could only recall the projects she worked on while in the program. The hands-on activities helped students to retain information and understand concepts. Students talked about being focused and engaged in activities that supported their inquiry-based learning style. Mark and Wells (2019) suggested that hands-on activities increase the knowledge of STEM concepts and interests. Although students had a high disposition and prior experiences in STEM-related capacities that attributed to their interest in STEM (e.g., early exposure, parental support, motivating teachers), the findings of this current study indicated that many kinds of hands-on projects and active learning opportunities supported positive interest in STEM. Furthermore, students' interest in hands-on activities supports research that suggests exposure to interactive projects helps to nurture the STEM interest of African American youths (Finkel, 2017; Rivera et al., 2019).

Theme 2: Sources of Support

Students identified one or more sources of support while participating in the program. All students stated that their parents found benefits and value in participating in the STEM program and helped students to enroll. Participant 6 said her grandfather transported her to their program from their home. Most students indicated that their parents did not force them to participate in the program and gave them the agency to make their own decisions regarding involvement. Moreover, students talked about the resources and tools their parents provided, which contributed to their success in the program. Students also spoke about how their parents' belief in their abilities influenced their self-perception, making program participation a meaningful experience. This finding supports the literature that suggests that parental engagement and attitudes are implicit indicators of how a student perceives themselves in their parent's eyes (Shillingford et al., 2017; Sithole et al., 2017; Verdin et al., 2018).

In this study, program leaders served as another source of support for the students while in the program. According to the students, positive program leaders were characterized as being helpful, resourceful, and intentional about fostering an environment of support. Students valued being perceived as intelligent and able to take on challenges by their program leaders. Most of the students talked about feeling nervous at the program's inception; however, they were eased by their program leaders' belief in their intellectual abilities. Lancaster and Xu (2017) suggested that program facilitators should focus on establishing positive relationships with Black youths and help them feel like they are a part of the learning community. Although most students had positive experiences with program leaders, one had an adverse experience as a participant in the program. Despite microaggressions and stereotypical comments expressed by her program lead, Participant 4 leaned on her family's support to persevere and complete the program. However, she was unsure whether the environment would have supported her persistence in STEM if she did not have supportive family members who were STEM professionals. Program leaders must be aware of their influence and actively try to foster the development of diverse student talent in their learning environments (Williams & Moody, 2019). This means program facilitators should receive ongoing cultural sensitivity training and be committed to supporting their students.

Theme 3: Early Exposure

Previous studies revealed that a substantial amount of research is available that examines the factors influencing students' decision to pursue a STEM major (Mohd et al., 2018; Mtika, 2019; Totonchi et al., 2021). As a result, emphasis on STEM pipeline programs has been a significant focus to increase African American representation in STEM career fields. Consistent with existing research, I found that parental influence and early exposure were among the main reasons students pursued a STEM major (see Davis, 2020; Shillingford et al., 2017; Weiss, 2019). Participants consistently talked about the time in which they became interested in STEM. Students stated that their interest in STEM was established as early as middle school. Exposure to their parent’s place of employment also contributed to this interest. Sheffield et al. (2018) found that youths develop a STEM career aspiration as early as adolescence, which is a strong indicator of their pursuit of a STEM degree.

Theme 4: Networking Opportunities

Networking opportunities allowed students to meet career professionals and engage with like-minded peers. Networking opportunities are essential in encouraging and disseminating information about unique experiences among students and career professionals who share similar interests (Sheffield et al., 2018). Students perceived networking as valuable and a pathway to future opportunities in STEM. Students enjoyed going on college tours in different states and meeting STEM professionals open to sharing their knowledge and expertise. Exposure to these educational and professional opportunities sparked greater interest in STEM among the students, supporting researchers' findings that students thrive and persist when they feel a sense of belonging to something bigger than themselves (Koch et al., 2015; Lancaster & Xu, 2017; Verdin, 2018). Although most previous research (Harris & Hodges, 2018; Wang, 2019; Williams & Moody, 2019) suggested that students need to network with African American professionals who have succeeded in STEM careers to see themselves as having a place in STEM, students in this study focused more on the welcoming and encouraging behaviors of those individuals rather than their race.

Theme 5: Lack of Diversity

Contrary to the perceived benefits but relatable shared experiences, students discussed the lack of diversity in the program. Students shared their experiences of being among the few African Americans participating in the program. Five students shared this experience, but their responses to the environment depended on their context and setting. For example, most students described feeling nervous initially about being among the few African American students in the program but learned to adapt and focused on "working hard." The nervousness subsided when they perceived the environment as welcoming, supportive, and affirming. Participant 5 shared experiences with microaggressions and discrimination. Although Participant 5 described this as a negative experience, her ability to overcome adversity was due to the support she received from her family, her ability to cope, and her intentional focus on her future goals. As suggested by previous researchers, these experiences confirm the need for continued training for educators to develop a culturally specific framework to understand systemic discrimination that can impact students' ability to reach their highest academic potential (Pino-Juste, 2020; Spencer & Tinsley, 2018; Velez & Spencer, 2018).

Theme 6: Self-Perception

In this study, self-perception was another emerging theme. Although students did not use the term self-perception, my understanding of self-perception and interpretation of student experiences was used to arrive at this meaning of the students' lived experiences. Self-perception in this study refers to students' views about themselves, their characteristics, and their judgments about the traits they possess (see Mohebi & Bailey, 2020). Students perceived themselves as "hard workers," "focused," "active learners," and "goal-oriented" while in the program. Self-perception, self-efficacy, and self-concept are widely explored constructs that motivate students to pursue STEM (Pino-Juste et al., 2020; Rosecrance et al., 2019). Much research around these constructs has centered on deficit-oriented ideologies, specifically in underserved and under resourced communities. However, students in this study did not perceive themselves as disadvantaged because they were from rural communities. Students in this study perceived challenges experienced in the program as opportunities for growth. Although this perspective may not reflect the entire rural student population, it highlights the need for researchers and policymakers to understand how context plays a role in student outcomes in rural communities.

Theme 7: Disconnect Between College Expectations and Student Preparedness

The lack of information about college expectations was another significant finding in this study. When students discussed their experiences related to college unpreparedness, most of the students used words such as "procrastination," "challenging," and "missed assignments" to describe their experiences as first-year college STEM majors. When students were asked to talk about their experience learning about college majors while participating in the program, most stated that the program did not cover information about the expectations of college STEM majors. Many students discovered the differences between high school and college expectations as first-year college students. Students noted that their lack of preparation was revealed after missing important assignments and their professor's inflexibility to change due dates. Their misconception of college expectations led to a challenging first-year experience as a STEM major. Researchers in previous studies found that the benefits of first-year college initiatives can help students acclimate to the expectations of colleges (Ontiveros, 2020; Patterson, 2020). However, to increase their understanding of college expectations, students perceived this preparation as beneficial if it was an aspect of a STEM precollege program.

Philosophical Approach and Theoretical Framework

One of Heidegger's (1982) goals in phenomenology was to uncover everyday existence and the meaning people construct from them. In the current study, lived experiences, as examined through the hermeneutic lens, focused on making explicit the students' perspectives to understand their meaning regarding their participation as African American students from rural communities in a STEM program. According to Heidegger's (1982) interpretative philosophy, my prior understanding and engagement of the subject under study were advantageous because I was embedded in the participants' world. Heidegger (1977) emphasized people's tendency to project meaning to text as a whole as soon as they develop meaning in its parts. Therefore, it was vital for me to interpret the students' experiences in the context of their life situations. Phenomenological themes were identified in the data through listening to, reading, dwelling on, and becoming immersed in the statements made by each student. The essence of each statement provided by the students was compared to the context of the whole text, allowing me to revise my interpretation until I reached a new understanding of the phenomenon (see Manen, 1992).

Hermeneutic Circle

The hermeneutic circle is one of the key concepts in hermeneutics and addresses understanding the participants' contexts (Gadamer, 2004). Heidegger (1982) believed that people could not understand a part without some understanding of the whole; understanding the whole requires understanding the parts. The hermeneutic circle aided the current data analysis process and constituted my understanding and interpretation of how students experienced STEM programs. Hermeneutic circling brought my experiences to the forefront and allowed me to explore and deepen the knowledge I had garnered earlier in my professional career. Hermeneutic circling also highlighted that my preunderstanding of this phenomenon was incomplete and imperfect (see Gadamer 2004). For example, I assumed the students perceived the scarcity of resources in their communities as a hindrance to their progression in STEM. However, students did not perceive the rurality of their communities as an issue. Following reflection, I interpreted the text individually and within the context of the entire transcript, my professional experiences, the reflective journal, and the PVEST framework when analyzing students' experiences. The constant circular movements between the parts and the whole deepened my understanding (see Heidegger, 1982; Laverty, 2003).

Working within the hermeneutic circle highlighted the importance of understanding contexts. According to Gadamer (1977), engaging in the hermeneutic circle requires researchers to acknowledge their prejudgments from where interpretations are derived. As a professional with an extensive background in higher education and one who lives in a rural community, my personal experiences were vital in identifying how my biases could have impacted the study. To this point, Heidegger's (1994) concept of Dasein's "being-there" aligned with the notion that being does not separate individuals from their experiences. As students shared their experiences with me, I applied Heidegger's concept of Dasein, using my experiences to connect with the student and encourage greater understanding.

PVEST Lens

The emerging themes of this study were examined through a PVEST lens because of its usefulness in understanding the role of contextual influence on the development of young people of color (Spencer et al., 1997). PVEST highlighted the impact of adequate support, context, the balance of risk contributors and protective factors, and learning environments that support the positive development of minority youth. Similar to hermeneutics, PVEST highlighted the influence of context and settings.

Net Vulnerability Level

The PVEST framework argues that individuals in a vulnerable social context are exposed to stressors at the ecological level (Spencer et al., 1997). Spencer (2006) asserted that the net vulnerability level is based on a balance of risk contributors and protective factors in a given context. Young people of color are subjected to risk factors such as race, gender, social class, health problems, and other identifying characteristics, often leading to educational and career disparities (Spencer & Tinsley, 2008). On the other hand, protective factors, which can include a stable and supportive family system, strong cultural and ethnic identity, good health, access to resources, and mentors, have proven to offset the adverse effects of risk contributors (Spencer, 2006). Students talked about being among the few African American participants, but each student experienced the lack of diversity differently. Some students experienced nervousness at the start of the program; however, students' fears subsided once they perceived a welcoming and accepting environment. Students were aware of the disparities; however, they perceived the program leaders, family members, and other community role models as affirming and supportive. Spencer (2006) asserted that how individuals see themselves regarding their identity and worth results from the messages they receive about risk factors in their environments. Young people appraise their experiences and develop behaviors and attitudes in response to risk and protective factors (Spencer & Tinsley, 2008).

Net Stress Engagement

Net stress engagement refers to the manifestation of risk contributors and protective factors in real-life encounters that has the potential to challenge the students' well-being (Spencer & Tinsley, 2008). Participant 5 shared specific negative experiences being among the few African Americans in the program. Participant 5 talked about microaggressions and was stereotyped by the notion that she was raised in a single-parent home when both her parents were present and successful professionals in the medical field. Participant's 5 effort to comply with the uniform standards of the program led to reprimand because of how her uniforms fit. This account supports research that examined the hypersexualizing of young African American girls, which tends to portray them as promiscuous or “less innocent” than their white peers (Epstein et al., 2017). Epstein et al. (2017) found that this misconception is often linked to harsher treatment and higher standards for African American girls. Despite high achievement in school, volunteer, and community service experiences, Participant 5 contended with demeaning stereotypes and sanctions that could have predisposed her to adverse outcomes. Fortunately, Participant 5 had more protective factors (social support) in her life that assisted in balancing the risk factors (Spencer & Tinsley, 2008). In examining Participant 5 self-organization in context, she understood that certain stereotypes and assumptions could be made about her being a girl of color. Participant 5 was conscientious of how to respond to the critiques related to her uniform and the stereotypes she experienced in a classroom among White peers. Participant 5 stated that the experience “motivated” her to “work harder.” More importantly, she was taught how to “embrace the skin I’m in” by her parents and other influential role models in the community. By the end of the program, Participant 5 stated that her experience “pushed me to keep going on and made me stronger.” Moreover, Participant 5 achieved resiliency through her ability to adapt to the stress of stereotypes and the disproportionate use of exclusionary discipline practices with the support of others. This supports Spencer’s (2006) assertion that adequate supports help young people learn how to cope with stressors.

Reactive Coping Strategies

In this current study, students discussed how they coped when faced with challenges in the STEM program. Participant 4 stated that she felt “out of place at the program's inception.” Admittedly, Participant 4 said that nobody in the program made her feel that way; however, she believes African American representation is essential and plays a pivotal role in her motivation. Participant 4 stated that the lack of diversity in the program was discouraging; however, she validated her concerns and focused on the program's benefits instead of the people in her environment. Participant 4 navigated challenges with feeling "out of place" in the program by maximizing the available options in her environment. Connecting with the few African American peers in the program helped Participant 5 to feel more comfortable. Integration of cultural goals motivated Participate 5 to continue working towards her academic pursuits because she believed African American representation in STEM is essential. Participant 5 also decided to attend an HBCU to be exposed to more African American students and professionals.

Participant 6 shared experiences with having challenges with communication as a participant in the program. Participant 6 experienced challenges communicating with other group members when working on projects. Participant 6 stated that because the program participants did not reside in his local community or attended his school, group members experienced challenges with varied communication styles. Participant 6 perceived this as a "pretty big challenge." Participant 6 also stated that initially, he had to "figure things out" when he felt confused about an assignment's objectives. Participant 6 learned to "stay focused" and "embrace challenges" by reciting positive affirmations and attributes this to perseverance in the program. This positive coping skill helped him view challenges as an opportunity to grow.

Participant 8 talked about his learning curve with physics as a participant in the program and initially perceived himself as the only one experiencing challenges. Participant 8 stated that he was one of the only students in the program who encountered physics for the first time. Participant 8 discovered his challenges while working with the MathLab program. Participant 8 stated that his physics struggles caused frustration; he often felt like “giving up.” Participant 8 was at risk of the stereotypes related to African American males that purportedly include hypermasculinity, violence, underachievement, laziness, and underemployment (Spencer, 2006; Totonchi et al., 2021). Despite exposure to this historically driven media-portrayed narrative, Participant 8 worked closely with a helpful professor who provided him with several online resources and tutorials that helped him to achieve a productive outcome. By the end of the program, he learned how to use MathLab while boosting his overall progress in the program.

In this study, participants’ levels of coping were based on their net level of vulnerability, protective factors, perceived support, and social context (see Spencer et al., 2006). Participants in these examples identified adaptive choices that minimized their net vulnerability while enhancing their self-efficacy. Participants did not develop this way of thinking independently because the support they received from family and affirmation from the adults in the environment were instrumental in overcoming challenges.

Emergent Identities

Spencer (1997) suggested that emergent identities define how individuals view themselves during various contextual experiences. In this study, the students in the program learned how to navigate challenges positively because of the support received from their peers, the reassurance from their parents, and the affirmation of their abilities received from their program leaders. It is important to note that evaluative efforts associated with the students' use of reactive coping methods are ongoing and developmental (see Spencer et al., 2006). These appraisals are based on what students thought about themselves (self-perception) and how others perceived them. Most of the students stated that the program leaders described them as "focused," "hardworking," and "active learners." Some students discovered that proactiveness in connecting to and working with their peers in the program led to longstanding relationships. Participant 1 had to overcome being "shy" by becoming a leader in many group activities. The program leader acknowledged her leadership qualities and helped her to create a mentoring program for children in the community.

Students in this study often navigated within and between varying family, school, and neighborhood contexts. Research has suggested that African Americans often juggle multiple contexts while making sense of contradictory environments (Spencer & Tinsley, 2008). Students participated in STEM programs in predominately White settings, attended schools in rural communities, visited colleges in different cities, and shadowed STEM professionals. The differing environments required students to adapt, understand social roles, and stabilize these environments through self and peer appraisal. For example, some students discovered differences between mastery of certain STEM subject areas among themselves and program participants.

Contrary to the demographics of their schools, students experienced among the only African American programs. In the case of Participant 5, she described her home and community as welcoming and supportive. However, she experienced microaggressions and discrimination as a program participant. These examples highlight the importance of preparing African American students to learn how to cope through self-regulation to help them navigate varying environments that may include negative experiences. By the end of the experience, students perceived themselves as "strong," having the skills to "get through obstacles," "can do anything I put my mind to regardless of my skin color," and have the "ability to find different solutions that are not always known or shared." Spencer (2006) posited that emergent identities could lead to productive or unproductive coping outcomes.

Life-Stage Specific Outcomes

The PVEST life-stage specific outcomes component refers to the productive and negative coping strategies that youth develop over time that affect overall results (Spencer 1997). Researchers have found that youths who use adaptive coping strategies to counteract adverse experiences are more likely to have successful transitions across settings (community, home, school) over time (Ozaki et al., 2020; Spencer, 2006). These positive experiences become stable parts of how they understand themselves and their futures. Essential to this process is how they experience and understand the environments they are immersed in, including the differences, risks, and available protective factors (Spencer & Tinsley 2008). Young people construct their identities by understanding themselves in these environments and engaging in these contexts (Spencer, 2006). Several factors can disrupt these processes, so it is vital to examine how students experience and interpret challenges in various settings to understand their potential effects on academic and career trajectories (see Spencer & Tinsley, 2008).

Although students overcame some of the challenges experienced in the program, their first year as STEM college students proved to be an environment they were unprepared for. All participants talked about their lack of preparedness as first-year college STEM students resulting in several adverse outcomes, which in some cases affected students' foundational identity of being hard, focused workers. Instead, many students described themselves as "procrastinators" with poor time management skills. Students admittedly acknowledged that support was available; however, they tried to work through the challenges independently. The lack of support has been linked to negatively affecting general productivity and can result in failing classes, dropping out of school, and underachievement (Rivera et al., 2019; Williams & Moody, 2019). Students shared that they missed deadlines, experienced inflexible professors, and received low grades in some of their classes. This example highlights the importance of ensuring students understand the environments they are immersed in, including an emphasis on risks and protective factors (Spencer, 2006). Students eventually connected with the supports available on campus reached out to their families, and began to take accountability to get back on track. Participant 5 stated she had to refresh her math skills and began to lean on her "support system" for help. Overcoming past challenges has given Participant 5 the tenacity to face roadblocks. Participant 5 perceived her professors as supportive and started visiting office hours for additional assistance. Participant 7 stated she discovered her learning style in a first-year seminar course, which helped her to study more effectively. Participant 1 began prioritizing and calendaring her work by getting a head start on more time-consuming assignments. These examples stress the importance of how young people cope with developmental challenges and utilize the resources and supports available to them.

In this section, I found the PVEST lens helpful in interpreting the emerging themes related to the student's identity formation to illustrate the importance of understanding this population's cultural and social contexts, thus deepening my understanding of the meaning of students created during their experiences. The PVEST lens highlighted the importance of creating supportive environments that help students develop their identities and skills, foster resiliency, and teach adaptive strategies should they face psychosocial challenges that can affect how they perceive themselves and others, thereby influencing their academic and future career goals.

Limitations of the Study

This study provides an essential contribution to the discussion regarding the experiences of African Americans from rural communities in a STEM program and whether their experiences influenced their decisions to pursue a STEM major in college. However, given the hermeneutic approach taken in this study, there were some limitations. First, this study involved a sample of African Americans from rural communities in Florida who participated in a STEM program and decided to pursue a STEM major in college. The demographics in this study do not represent all races from rural communities in Florida who share an experience with participating in a STEM program. Generalization of specific findings of the study may be challenging. However, as Guba and Lincoln (1985) suggested, I provided thick descriptions of where and how the data would be collected, an outline of logical steps for analysis, and my assumptions and professional experiences that could have influenced the research process. Future researchers can follow the procedure and consider including more participants from other areas (urban, suburban, etc.), which may enhance, alter, or improve the findings of a more extensive study.

Next, some may argue that a small sample size risks the study's power and significance, rendering it meaningless (Bartholomew et al., 2021; Moser, 2017). One of the goals of phenomenological research is to recruit participants with a shared experience of the phenomenon under study (Creswell, 2007). Many have argued about the appropriate sample size in phenomenological research. Heidegger (1958) does not outline a straightforward method for phenomenological research concerning sample size because the focus is on the interpretation of experiences of study participants and the explication of the meaning of being. The first mention of sampling within phenomenology was referred to by Manen (1992), who suggested that sample size in a phenomenological approach is irrelevant. Manen further postulated that it is impossible to reach empirical generalization using a phenomenological methodology. My goal in this study was to ensure that the participants' voices were heard; however, procedures for collecting and analyzing the data were established and outlined, as Giorgi (1997) encouraged. With this in mind, Polkinghorne (1989) suggested that phenomenological studies should seek to contain participant samples between 5 and 25. My sample size of eight participants allowed me to capture rich textual descriptions of how students ascribed meanings to their experiences (see Polkinghorne, 1989).

Finally, my professional experiences in higher education and living in a rural community might be perceived as a limitation in other methods. However, a hermeneutic phenomenological study encourages researchers to bring their preunderstandings to the study as it is an integral part of the research process that contributes to interpreting experiences (Gadamer, 2004). Although experiences can be used in a hermeneutic study, I used the hermeneutic circle and reflective journal to ensure that the focus was on the students' experiences and not what I brought to the experience.

Recommendations

It is recommended that researchers continue to create platforms where African American students from rural communities can share their unique experiences so that program developers have insight into how they ascribed meaning to their STEM program experiences. Current literature regarding the experiences of African American students from rural communities relating to their experiences in STEM programs is lacking. Crumb and Chambers argued (2022) that much research on African Americans from rural communities comes from a deficit-oriented framework centered on youth needing "fixing." Researchers can continue capturing the unique experiences of African American youth from rural communities and use them as a guide to construct culturally relevant support systems.

One of the components of PVEST suggests that young people must fully understand the changes, risk contributors, and protective factors of the environments in which they are immersed (Spencer & Tinsley, 2008). In this study, students shared challenges as first-year STEM majors in college. Students perceived themselves unprepared for college expectations; however, they did not believe their communities' rurality influenced this perception. Future researchers can examine how students from rural communities perceive and understand college expectations as STEM students before matriculation. Moreover, how this perception affects their identity during the first year of college.

The sample size of this phenomenological study was small, consisting of six females and two males. Given this disparity, it is recommended that future researchers focus on examining the experiences of African males due to limited research on this population. More importantly, gaining a deeper understanding of how African American males negotiate and navigate stressful environments that may not be well understood.

Last, all of the students in this study either had parents who worked in a STEM profession or were college graduates. Students were exposed to STEM careers at an early and developed an interest as early as middle school. Students' interests were nurtured by a family member who provided opportunities for their children to experience the environment through their places of employment or another STEM connection. Future researchers can focus on examining the lived experiences of first-generation students from a rural community in a STEM program who decided to pursue a STEM degree.

Implications

The study results provide insight to stakeholders to be better informed when creating and implementing policies, STEM pipeline programs, and educational opportunities for African American students in rural communities. The students' experiences confirm the need for continued training for educators to develop a culturally relevant, research-based framework to understand how systemic discrimination, microaggressions, and the personal prejudices of others can negatively impact students of color. Awareness of systemic problems that African Americans may face is essential. However, it is equally important to assess assumptions that tend to limit students' potential. Students in this study talked about their parents' and program leaders' affirming behaviors toward their academic abilities. This support contributed to their identity and overall confidence. Within this context, parents, program leaders, and educators did not view the students within a deficiency framework that is commonplace surrounding rural education. Instead, a strength-based framework proved to be more impactful and motivated students' ability to reach their highest academic potential. A strength-based framework builds upon an individual's strengths, seeing the person as resourceful and resilient when they experience adverse conditions (Hayes & King, 2018). Programmatic approaches must identify, incorporate, and reinforce individualized coping skills and community-based adaptations developed by African American youth.

Most students talked about the lack of diversity in STEM programs. Students spoke highly about the knowledge that the program leaders possessed in STEM. However, most of the program leaders were Caucasians. An abundance of research supports exposing students to successful African American STEM professionals is highly regarded in their pursuit of a STEM profession (Coleman, 2020; Kendricks et al., 2019). Students who valued African American representation stated that they intentionally decided to attend an HBCU because they wanted to experience an environment of professionals who look like them. Also, students wanted to be amongst more of their African American peers. This demonstrates a continued need for learning spaces headed by African American mentors and role models in the STEM field before students matriculate to college.

Using the PVEST framework in this study highlighted the need for students to understand risk contributors they may encounter and protective factors that mitigate those risks impacting their ability to face and overcome challenges. Programs might include features focusing on students identifying and understanding the importance of protective factors and how to continue building upon the reactive coping skills should they experience challenges. Some students revealed the challenges presented in the program and their abilities to overcome them. However, during their first year of college, students indicated they needed more preparedness for the expectations and rigor of college. When faced with this new environment, students could not manage their time, causing missed deadlines and a decline in grades for most. Although programs should provide extensive information about college preparation to increase understanding of college expectations, students could learn more about identifying and using adaptive coping skills for managing stressful situations as described in component five of the PVEST model. In doing so, students can learn to use coping methods previously employed to resolve future dissonance-producing situations. Spencer (2006) suggested that this life stage is essential in development because it involves identity formation and future behavior and outcomes related to achievement, self-esteem, and health.

Students placed value on the support they received from their parents. Students' accounts were associated with their early exposure to STEM career fields. Students also talked about their parents being essential to their continued pursuit of STEM following their initial interest. Stakeholders can consider exploring opportunities that include active parent involvement in their programmatic efforts, given that early exposure lays the foundation for later learning (see Zucker et al., 2021).

Conclusion

The disproportionate number of African Americans in STEM has gained national attention and become a significant cause of concern. Despite the increased federal dollars invested in diversifying toward STEM program initiatives, the U.S. Bureau of Labor Statistics (2021) reported that the STEM workforce makes up 9% of African Americans. Recognizing that an individual would, in most cases, need an education in STEM to advance to specific STEM career opportunities, examining the experiences of African American students in rural communities could add to the literature, given the lack of qualitative research in this area. This study revealed that African American high school students from rural communities have unique experiences that need to be a part of stakeholders' conversations when creating opportunities. The hermeneutic philosophical approach and methodology were essential in this study because they highlighted the importance that lived experiences are always subject to interpretation. It also embraces the researcher's prior understanding of the subject matter, using it as a guide in the inquiry. A PVEST lens complemented this study because the framework emphasizes the importance of context and the meaning-making process of African American youth. More importantly, it helped us examine and understand strength and resiliency during the students' identity formation process.

The research questions in this study were what were the lived experiences of African American first-year college students in a STEM program, and how did the experiences influence their decision to pursue a STEM major in college? Findings conclude that students' decision to pursue a STEM major was based on their perception of various sources of support, affirmation of their abilities, and early exposure to STEM through visiting professional work environments, which many reiterated was experienced before participating in the program. Additionally, parental influence and involvement are essential to fostering students' interests. This substantiates Spencer's belief that under supportive conditions and access to resources, individuals' interests can be nurtured and subsequently fulfilled (Spencer et al., 1997). With this in mind, stakeholders must continue to advocate for African American youth from rural communities but, more importantly, create spaces where they can share their unique meaning-making experiences that lead to positive outcomes.

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Appendix: Interview Guide

Hello, my name is Angela Blount, and I am a doctoral student pursuing a degree in Human and Social Services with a concentration in Higher Education. This interview is being conducted to get your input about your participation in the STEM program. I am especially interested in your experience and perception of the program and if the program informed your decision to pursue a STEM major.

With your approval, I will be tape-recording our conversation. The purpose of this is to get all the details, but at the same time, it will allow me to carry on an attentive conversation with you. I assure you that all your comments will remain confidential. I will compile a report containing all participant responses without reference to specific individuals. Do you have any questions about this process?

Demographic Questions

1. How old are you?
2. Where do you currently reside? What city are you from?
3. Are you a freshman (first-year college student with at least 0-29 credit hours)?
4. What is your major?

Questions

1. Describe in detail your STEM program experience.
2. Describe your perception of the program leaders in the STEM program.
3. Describe how you believe the program leaders in the STEM program perceived you.
4. Describe your perception of yourself as a participant in the program.
5. Share a positive experience that you had in the program.
6. Describe your guardian's involvement while you were participating in the program.
7. Describe your perception of the other program participants.
8. Describe some of the challenges that you had while being in the program. How did you overcome those challenges?
9. Tell me something you learned about yourself after completing the program.

10. How did you perceive the process of getting into the program?
11. Tell me about your experience learning about college majors while participating in the program.
12. What is your perception of STEM majors as a first-year college student?
13. Describe how the experiences in the program influenced your perception of STEM majors.
14. How did your experiences in the program influence your decision to pursue your current major?
15. Is there anything you would like to add that I have not asked about your experience?

Closing Statement

Thank you for taking the time to answer the questions in this interview. Your answers are a valuable part of this research. I will analyze the information you and others gave me and send a copy to review to ensure I captured the information you intended to convey. Thank you for your time.