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Rural Science Teachers' Intentions of Integrating STEM Career-Related Lessons

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Shuniqua Hart

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Walden University
2018

Abstract

Rural Science Teachers' Intentions of Integrating STEM Career-Related Lessons

by

Shuniqua Hart

MA, South Carolina State University, 2008

BA, Claflin University, 2006

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

Education

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Abstract

Researchers have shown rural elementary and middle-grade science teachers' inability to integrate STEM career-related lessons into their curricula despite engagement in professional development linked to the teachers' intent-driven beliefs. Researchers, however, have not investigated the influence of intentions on teachers' abilities to integrate STEM career-related lessons into science instruction. The purpose of this transcendental phenomenological study was to understand how intentions impacted rural elementary and middle-grade teachers' ability to integrate STEM career-related lessons during science instruction. Guided by Ajzen's (1988) theory of planned behavior, this study was designed to examine teachers' intentions to integrate STEM career-related lessons during science instruction and the underlying causes of such intentions. In this transcendental phenomenological study, reflective journal entries and interview data were collected through purposeful sampling of 10 rural elementary and middle-grade science teachers. Data were analyzed using a modification of the Van Kaam method of analysis. Findings showed that teachers intended to regularly integrate STEM career-related lessons, but needed more support from their administrators, colleagues, and community partners in fulfilling their intents to integrate STEM career-related lessons. Additional studies are needed for an increased understanding of how teachers in rural areas intend to integrate STEM career-related lessons amid challenges rural teachers face. This study may be of benefit to administrators and teachers who want to unite efforts in constructing a positive climate of integrating STEM career-related lessons during science instruction.

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Dedication

I would like to dedicate this dissertation to several organizations where STEM education is woven into the fabric of their existence. These organizations include, but are not limited to: The National STEM Foundation, STEM Equity Pipeline, The National Girls Collaborative Project, Girlstart, and Coalition for Science Afterschool, Forum for Youth Investment, Foundations Inc., 4-H Set Initiative, National Science Foundations, United States Department of Education, and Noyce Foundation. Each of these organizations deserves a thank you for their focus on STEM education and commitment in providing leadership, training, and guidance to educators desiring to make science education an attractive, rewarding, and stimulating experience.

I also dedicate my dissertation to my family. We are finished with this race. To my children, Yaneekwah and Shannon, Jr., Mommy did this for you. Thank you for your understanding, patience, and for being my loudest fans during this lengthy process. To my husband, Shannon, thank you for being there for me through it all.

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Finally, reaching this milestone in my dissertation journey is a feat that I could not have accomplished without support. As a result, I must now take the time to individually thank the wonderful, supportive people who have rendered aid in some form or fashion. I appreciate Dr. Justus Randolph and Dr. Janice Garfield for their roles as chairperson in the early stages of my dissertation development. I am also appreciative of Dr. Janice Garfield and Dr. Deanna Boddie for leading me towards STEM education as a research topic. There are not enough words in the English language to thank Dr. Ruby Burgess for stepping in as my chairperson when all seemed pointless. I cannot believe you stayed with me for four years never losing patience, always being optimistic, and giving the type of guidance I did not even know I needed to get even remotely close to the point where I am now. I also must sincerely thank Dr. Katina Pann for stepping in as my committee member, rolling your sleeves up, and a year later, steering me to having a completed dissertation. The same is also to be said of Dr. Danielle Hedegard, my university research reviewer, and Dr. Cheri Toledo, my program director who I would also like to thank for overseeing my dissertation process.

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Chapter 1: Introduction to the Study

Introduction

In light of recent changes to educational policy, teachers are expected to modernize science instruction. The modernization of science instruction requires that teachers understand current science reforms and design instruction that meets the authentic needs of students. Recent Science, Technology, Engineering, and Mathematics (STEM) reform measures in the United States advocate for career-relevant lessons. The integration of STEM career-related lessons during science instruction could assist teachers in making relevant STEM connections transparent, deeper, and more meaningful (Crippen et al., 2015; Kelley & Knowles, 2016; McDonald, 2016; Stohlmann, Moore, & Roehrig, 2012; White, 2014). However, there is limited research on rural elementary and middle-grade teachers' integration of STEM career-related lessons during science instruction (Avery, 2013; Boscia, 2013; Dejarnette, 2012; Ku & Capolupo, 2014; Nadelson, Callahan, & Pyke, 2013; Parker & Lazaros, 2014; Reeve, 2015). In the context of this study, integrating STEM career-related lessons during science instruction entails including STEM career advice, information, and guidance into related science lessons for the purpose of connecting the science lessons on relevant STEM careers (Reiss & Mujtaba, 2017).

Integration of STEM career-related lessons during science instruction could potentially aid rural elementary and middle-grade teachers. Rural elementary and middle-grade teachers are expected to make STEM education relevant to students' daily lives so students associate the benefits of STEM education with their community's economic well-being (Avery, 2013). Integration of STEM career-related lessons is relevant in rural science education because this practice connects STEM to students' interests and daily lives regardless of geographical location (United States Department of Education, Office of Innovation and Improvement, 2016). Integration of STEM career-related lessons can assist teachers in addressing students’ interests during the daily requirements of rural science education. Findings of this study may provide teachers with a better understanding of how integration of STEM career-related lessons meets the science educational needs of rural students.

In this chapter, I provide a summary of current literature on the integration of STEM career-related lessons in science instruction. I also provide an overview of the study, including the problem, purpose, research questions, conceptual framework, and nature of the study. In addition, I present operational definitions, assumptions, delimitations, and limitations, and conclude by discussing the significance of the study.

Background

Modernizing science instruction requires teachers to use STEM. In addition to the academic disciplines of science, technology, engineering, and mathematics, STEM refers to the integration of associated instructional practices and learning activities (McDonald, 2016; Nedelson & Seifert, 2014). Integrating STEM career-related lessons is an effective instructional practice to use in science classrooms to create apparent connections between students’ interests, classroom lessons, and real-world applications (Cohen et al., 2013). However, integrating such STEM career-related lessons has been difficult for teachers.

Numerous researchers have documented difficulties teachers face with integrating STEM career-related lessons. Many teachers experience challenges with limited science knowledge, negative attitudes, and confidence levels (Thomson & Gregory, 2013). Owens (2014) note that teachers are often unsure of how STEM career-related lessons should be integrated in grades K-5. Other researchers note teachers' lack of STEM career knowledge (Reiss & Mujtaba, 2017). In spite of these difficulties, effective integration of STEM career-related lessons suggest a need to add STEM careers.

Integrating STEM career-related lessons during science instruction requires teachers be knowledgeable of those careers. Carrico et al. (2016) report that teachers often lack STEM career knowledge but are nonetheless responsible for integrating STEM career-related lessons into their instruction. However, Avery and Reeve (2013) and Turner (2013) find that teachers are sometimes resistant to such responsibility. In these studies, teachers report a lack of pedagogical strategies and resources to add careers to their STEM career-related lessons.

In rural communities researchers have found that such integration is problematic because teachers are expected to be ambassadors for STEM careers in contexts where isolation, underfunding, and limited resources are already challenges (Avery, 2013; Reiss & Mujtaba 2017; Watermeyer et al., 2016). I found a larger problem when further investigating the challenges rural teachers have with integrating STEM career-related lessons during science instruction. The larger problem was the scarcity of research on rural teachers' beliefs on integrating STEM career-related lessons during science instruction. Such literature is particularly scarce on elementary and middle-grade teachers. Shahali et al. (2015) state that many scholars and researchers have found that beliefs about STEM integration correlated with teachers’ knowledge and attitudes.

According to Thomson and Gregory (2013), “Teachers’ beliefs were powerful tools in directing classroom behaviors and influencing teachers’ behaviors with planning, instructional decisions, and professional practices” (p. 1803). Ajzen (1988, 1991) posit that beliefs are linked to intentions and suggested teachers' intentions direct their behaviors for integrating STEM career-related lessons into science instruction. Other researchers (Dailay, 2013; Opperman, 2015; Owens, 2014; Turner, 2013; Webb, 2015) have suggested that teachers' knowledge or attitudes about STEM could influence their intentions. However, little was known about rural teachers' intentions of integrating STEM career-related lessons into science instruction during the elementary and middle-grades and how such intentions could influence science instruction. Understanding teachers' intentions in integrating STEM career-related lessons into science instruction during the elementary and middle-grades may result in recommendations resulting in more teachers successfully integrating STEM career-related lessons during science instruction. Based on the gap in the literature, I determined that a need existed to conduct this study.

Statement of the Problem

Much of the literature has shown that rural elementary and middle-grade teachers were unable to integrate STEM career-related lessons during science instruction despite engagement in professional development. While literature has shown professional development could be influential in altering aspects of teachers’ beliefs regarding integrating STEM career-related lessons, there were no studies addressing all aspects of teachers' beliefs or the underlying causes of such beliefs. In several studies, rural elementary and middle-grade teacher participants demonstrate changes in knowledge, attitude, and confidence, but were not confident in their abilities or were unsuccessful in integrating STEM career-related lessons during science instruction (Capobianco & Rupp, 2014; Clark et al., 2015; Ertmer et al., 2014; Glover et al., 2016). Additionally, some of the literature shows that higher perceptions of attitude, subjective norms, and perceived behavioral control positively impacted teachers' intentions in integrating STEM career-related lessons, but I found limited research regarding how intentions could influence rural elementary and middle-grade teachers' integration of STEM career-related lessons (Lin & Williams, 2015; Madera, 2016; Shahali et al., 2015). More importantly, I found no studies focused on why some rural elementary and middle-grade teachers were better able to integrate STEM career-related lessons during science instruction than others. Thus, a better understanding was needed of rural elementary and middle-grade teachers' intentions regarding integration of STEM career-related lessons during science instruction. My examination of the topic and how intentions influence teachers' beliefs could help provide answers to why some rural elementary and middle-grade teachers are unable to integrate STEM career-related lessons into their teaching.

Purpose of this Study

The purpose of this qualitative study was to understand how intentions impact rural elementary and middle-grade teachers' integration of STEM career-related lessons into science instruction. I used a transcendental phenomenological approach in this study.

Transcendental phenomenology is the study of an individual's experience through the individual's consciousness; whereas phenomenology is defined as the study of an individual's experiences as relayed through the individual's given examples (van Manen, 2017). Consciousness, in this case, could be described as an individual's natural state of awareness (Cerbone, 2014). Researchers use transcendental phenomenology to find the genesis of an individual's knowledge based on the individual's conscious experiences (Jansen, 2017).

I interviewed rural elementary and middle-grade teachers in one state in the southeastern United States to understand their conscious experiences. The interviews focused on understanding teachers' firsthand accounting of intentions, beliefs, influences from subjective norms, perceived capabilities, perceived enablers, and barriers to integrating STEM career-related lessons during science instruction. Participants' interview responses provided insight into why rural elementary and middle-grade teachers in one state in the southeastern United States were unable to integrate STEM career-related lessons during science instruction despite engaging in professional development. Participants' interview responses also provided clarification about whether rural elementary and middle-grades science teachers in one state in the southeastern United States integrated STEM career-related lessons during science instruction regularly, intermittently, or rarely.

Research Questions

I developed the following research question and subquestions to explore rural teachers' intentions of integrating STEM career-related lessons:

RQ1: What are intentions of rural elementary and middle-grade science teachers as they pertains to integrating STEM career-related lessons during science instruction?

SQ1: What do rural elementary and middle-grade science teachers believe about integrating STEM career-related lessons during instruction in the elementary and middle-grades?

SQ2: How do rural elementary and middle-grade science teachers describe influence from subjective norms in integrating STEM career-related lessons during science instruction to elementary and middle-grade students?

SQ3: What resources do rural elementary and middle-grade science teachers describe as impacting their participation in integrating STEM career-related lessons during science instruction to elementary and middle-grade students?

SQ4: How do rural elementary and middle-grade science teachers perceive their capability in integrating STEM career-related lessons during science instruction to elementary and middle-grade students?

In Chapter 2, I explain how these questions align with the theories, themes, and key concepts I used for this study.

Theoretical Framework

I chose Ajzen's (1988) theory of planned behavior as the theoretical framework for this study. Ajzen theorized that intentions link individuals' beliefs to their behavior. The major constructs in the theory of planned behavior are intentions, beliefs, attitude, subjective norms, and perceived behavioral control. Intentions are the result of one's perceived capability to perform the behavior (Sandberg et al., 2016). Attitude refers to the individual’s attitude towards the behavior (Ajzen & Sheikh, 2013). The behavior is a reflection of an individual’s assessment and is subject to change (Ajzen & Sheikh, 2013). Subjective norms refer to an individual's perceived social pressure to perform the behavior (Lin & Williams, 2015). In the case of this research, administrators, community members, district leaders, and science department heads represented subjective norms. Perceived behavioral control refers to “the perceived ease or difficulty of performing the behavior” and is “assumed to reflect past experiences as well as anticipated impediments and obstacles" (Ajzen, 1988, p. 132).

I selected the theory of planned behavior because it provided a framework for designing behavioral change interventions based on teachers’ intentions (Steinmetz et al., 2016). In the theory of planned behavior, Ajzen (1988) used these major constructs to describe the behavior formation process that resulted from underlying conscious intentions. In addition, Ajzen included a description of how these intentions resulted from one's perceived capability to act (Ajzen, 1988, 1991; Doll & Ajzen, 1992). Intentions could also capture the factors that motivated one to perform or not perform the behavior. Ajzen (2015) contended that the theory of planned behavior could help in situations where behaviors requiring modification need to be identified so intention changes can be produced. However, for the intention to manifest into the behavior desired, those with the intention must have access to needed resources and potential barriers to performing the behavior need to be eliminated (Ajzen, 2015). I used the theory of planned behavior as a means of understanding rural elementary and middle-grade teachers’ intentions to integrate STEM career-related lessons during science instruction. In addition, I used the theory to uncover perceived enablers and barriers to integrating STEM career-related lessons during science instruction.

Nature of the Study

In this study, I investigated teachers' intentions to integrate STEM career-related lessons. In addition to the academic disciplines of science, technology, engineering, and mathematics, STEM refers to the integration of associated instructional practices and learning activities (McDonald, 2016; Nedelson & Seifert, 2014). Specifically, I focused on 10 elementary and middle-grade teachers' intentions to integrate STEM career-related lessons related to science and science-related fields. In this study, elementary teachers comprised those who teach Grades 3, 4, and 5; while middle-grade teachers were teachers of Grades 6, 7, and 8 (Bureau of Labor Statistics [BLS], 2017).

Potential research participants were full-time science teachers employed in rural school districts in one state in the southeastern United States. I defined rural school districts as those located outside of large towns and cities. In the context of this study, the integration of STEM career-related lessons entailed teachers integrating STEM-career advice, information, and guidance into related science lessons for the purpose of connecting the career relevancy of STEM to science lessons (Reiss & Mujtaba, 2017). Sample STEM careers teachers might discuss during the course of their science instructional periods included physicist, geologist, environmental scientists, ecologist, and biotechnician (BLS, 2014). I used a transcendental phenomenological study to investigate rural elementary and middle-grade science teachers' intention to integrate STEM career-related lessons.

The transcendental phenomenological approach requires researchers to deviate from the typical active role undertaken by phenomenological researchers. Instead, transcendental phenomenological researchers undergo phenomenological reduction. To undergo phenomenological reduction means the researchers detach themselves from the study so they can set apart what is happening in the world from how research participants' viewed their experiences with what was happening in the world. The rationale for the researcher's assumption of a detached role is that the phenomena under study can be viewed objectively without the researcher bringing in her or his attitude, experiences, theories, and assumptions (Christensen, Welch, & Barr, 2017). In the context of this study, this meant I did not influence the participants' understanding of the phenomena being studied (see Chan, Yuen-ling, & Wai-tong, 2013).

In addition, three components form the basis of the transcendental phenomenological research approach: intentionality, eidetic reduction, and constitution of meaning. Intentionality is the manner in which consciousness holds onto an object (Applebaum, 2014; Levy, 2016). In the concept of intentionality, the intentional act of grasping the object is the noesis, while the object being grasped is the noema (Husserl, 1977). Eidetic reduction involves analyzing of the essences of the phenomenon to unearth its basic components (Bernet, 2017; van Manen, 2017). Constitution of meaning is the assigning of meaning to the resulting unearthed basic components (Bernet, 2017; van Manen, 2017).

The need for a transcendental phenomenological study was substantial given the plethora of variances and issues associated with teachers' STEM integration experiences.

Research findings accentuated the need to interview teachers on factors that influenced integration of STEM career-related lessons and analyze the essences of individual teachers’ experiences as grasped by teachers’ conscious minds. Such analysis is necessary if interventions to improve the quality and frequency of STEM career-related lesson integration are to be effective (Emanuel Gros, 2017; Padilla-Diaz, 2015). The results from this study could help inform administrators about how rural elementary and middle-grade teachers' intentions impacted science instruction and factors that lead rural elementary and middle-grade teachers to integrate STEM career-related lessons regularly, intermittently, or rarely during their elementary and middle-grades science instructional periods.

My use of Ajzen's (1988) theory of planned behavior could help to expand scholarly understanding of the connection between rural elementary and middle-grade teachers' intention of integrating STEM career-related lessons during science instruction and the frequency in which successful integration of STEM career-related lessons during science instruction occurred. As previously stated, four main constructs formed the theory of planned behavior-intentions, attitudes, subjective norms, and perceived behavioral control.

I used a modification of the Van Kaam method of analysis for phenomenological data, as recommended by Moustakas (1994), for this study. The van Kaam method of phenomenological data analysis involved a series of seven steps. Step 1 involved listing and grouping every expression relevant to each individual participant’s experiences and instructional practices. Step 2 involved reducing and eliminating expressions that showed no relation to participants' experiences and instructional practices. Step 3 involved clustering and labeling the invariant constituents or categories. Step 4 involved validation of the themes. Step 5 involved constructing an individual textural description of participants' experiences and instructional practices. Step 6 involved constructing an individual structural description of experiences and instructional practices associated with integrating STEM career-related lessons during science instruction in the elementary and middle grades. Step 7 involved composing a textural-structural description of the meanings and essence of experiences and instructional practices relative to integrating STEM career-related lessons during science instruction in the elementary and middle grades.

Definitions

Definitions considered of value to understanding unfamiliar terminology pertinent to the context of this study were as follows:

Attitude: "A predisposition to respond favorable or unfavorable to an object, person, institution, or event" (Ajzen & Sheikh, 2013).

Capability: One's perception of ability to perform a particular task (Armitage, 2015).

Intentions: The result of one's perceived ability to perform the behavior (Sandberg, Hutter, Richetin, & Conner, 2016).

Local rural knowledge: The theory that rural children obtain STEM knowledge from their daily lives (Avery, 2013).

Perceived behavioral controls: "The perceived ease or difficulty of performing the behavior and was assumed to reflect past experiences as well as anticipated impediments and obstacles" (Ajzen, 1988, p. 132).

Planned behavior: A theory rationalizing actions can be predicted, explained and changed by looking at an individual's intentions to perform a particular behavior (Steinmetz, Knappstein, Ajzen, Schmidt, & Kabst, 2016).

Science, Technology, Engineering, and Mathematics (STEM) education: An interdisciplinary approach to learning whereby science, mathematics, engineering, and technology concepts applied to real world endeavors (Spellman, Jones, and Katsioloudis, 2014).

Subjective norms: An individual's perceived social pressure to perform a behavior (Lin & Williams, 2015).

Assumptions

In this study, I assumed the following:

- Rural elementary and middle-grade teachers would be available and able to participate in this study. The rational for this assumption was the reliance on the availability of research subjects needed in qualitative studies (Barnham, 2015).
- Rural elementary and middle-grade teachers would be honest and straightforward when answering interview questions. The rationale for this assumption was the requirement of the transcendental phenomenological researchers to accept accountings as absolute truth (Padilla-Diaz, 2015).

Scope and Delimitations

Many boundaries limited the scope of this study. Restrictions for this study included interviewing only third through eighth-grade science teachers about their intentions of integrating STEM career-related lessons during science instruction. No attempt was made to include the intentions of students, administrators, parents, or community stakeholders. Omitting teachers of other subject areas and educators of grades outside of third through eighth delimited this study. Additional intentions related to the science classroom environment, school climate, and the impact of high stakes testing on science instruction, for example, could provide additional data but were not within this study's scope.

Further delimitations of this study included the restriction of data collection to school districts identified as rural. No attempt was made to include urban or suburban school districts. A comparison of the intentions of rural elementary and middle-grade science teachers to teachers of the same grade levels in other geographical locations could provide additional data but were beyond the scope of this study. I also restricted the scope of this study to STEM careers directly related to science. Since I was seeking to study rural elementary and middle-grade science teachers' intentions of integrating STEM career-related lessons during science instruction in the elementary and middle grades, non-science-related STEM careers were not within this study's scope.

Limitations

There were several limitations outside of my control that may have influenced the outcome of this study. These limitations included absence of longitudinal effects, finances, and access to research participants for adequate sample representation of rural elementary and middle-grade teachers on STEM career lesson integration. The amount of time allotted for the study was a limitation to the scope of this study. Not more than a three-month interval was envisioned for the collection and analysis of data. Conducting a longitudinal study could provide additional information of value to the proposed study, but exceeded the scope of the study. In addition, the purposeful sampling of 10 participants could not consistently represent rural elementary and middle-grades science teachers' intentions of integrating STEM career-related lessons on a national or international scale. Thus, transferability of findings is limited. Additionally, researcher bias may have influenced data collection and the study's outcome. I addressed such bias in a bracketing journal, by member checking, and through the use of an audit trail.

Significance of the Study

A potential contribution of the study was providing information to the consolidated school districts that served as my study sites and similar school districts about how beliefs could inform rural elementary and middle-grade teachers' intentions of integrating STEM career-related lessons during science instruction. According to Thomson and Gregory (2013), teachers' beliefs profoundly inform their pedagogical practices. Researchers have also suggested that increased knowledge, positive attitudes, higher levels of perceived behavioral control, and subjective norms could lead to stronger STEM integrating intent (Lin & Williams, 2015; Shahali et al., 2015). Data collected and analyzed from this study could advance knowledge in STEM education, leading to improved practice by assisting educators in creating an atmosphere that supports teachers' intentions to integrate STEM career-related lessons during science instruction.

It could influence positive social change by leading to localized professional developments geared towards training rural elementary and middle-grade science teachers on how to incorporate lessons on STEM careers during science instruction. Motivating teachers to incorporate lessons on STEM careers during science instruction in the elementary and middle-grades could also assist in producing a cadre of young students more aware of potential STEM career options. This assistance could lead to more teachers motivating students to take advanced science courses in high school. In addition, it could assist teachers wanting to encourage students to pursue and graduate from STEM-related degree programs. Ultimately, this encouragement could lead to more students going into STEM professions, possibly alleviating the shortage of STEM workers to fill vacancies in STEM fields.

Next, this study could heighten awareness of the influence teachers have on students' pursuits of STEM-related career paths. This influence might lead to more teachers modifying their beliefs about STEM careers. If teachers are influenced to modify their perceptions about STEM careers, then they might view students' entry into STEM careers as a valuable outcome. The teachers' intentional desire to integrate STEM career-related lessons may overshadow any potential barriers that inhibit them. This may thereby lead to additional rural elementary and middle grade teachers integrating STEM career-related lessons during science instruction and thereby intensify the frequency of such integration experiences.

An additional implication for positive social change is that this study may help administrators be informed about how teachers' intentions impact science instruction. It may also inform administrators as to whether teachers integrate STEM careers-related lessons regularly, intermittently, or rarely in their elementary and middle-grade classrooms. Knowing this information could assist administrators in making more informed decisions in respect to professional development. This information might assist with the development of localized professional development geared toward training more teachers to engage in STEM career-related lesson integration during science instruction. It could also present additional opportunities for those who already integrate STEM career-related lessons during science instruction to collaborate with others with similar intentions.

Summary

In Chapter 1, I presented the main details of the study in order for readers to understand what the study is about and why the study was important. I also included a concise synopsis of background literature in support of the little known intentions of rural elementary and middle-grade science teachers integrating STEM career-related lessons. Also, I included the research question and theoretical framework aligned with Ajzen's (1988, 1991) theory of planned behavior. Additionally, I addressed the nature of the study, operational definitions, assumptions, scope, delimitations, and limitations of the study. Finally, I presented the significance of the study. In Chapter 2, I review the scholarly and professional literature.

Chapter 2: Literature Review

Introduction

Much of the literature has shown that rural elementary and middle-grade teachers are unable to integrate STEM career-related lessons during science instruction despite engaging in professional development. While some studies have shown that professional development could be influential in altering aspects of teachers' beliefs regarding integrating STEM career-related lessons, I found no studies that addressed all aspects of teachers' beliefs or the underlying causes of such beliefs. In several studies, rural elementary and middle-grade teachers demonstrated changes in knowledge, attitude, and confidence, but were not confident in their abilities or were unsuccessful in integrating STEM career-related lessons during science instruction (Capobianco & Rupp, 2014; Clark et al., 2015; Ertmer et al., 2014; Glover et al., 2016). Additionally, some of the literature showed that higher perceptions of attitude, subjective norms, and perceived behavioral control positively impacted teachers' intentions in integrating STEM career-related lessons, but there was limited research regarding how intentions could influence rural elementary and middle-grade teachers' integration of STEM career-related lessons (Lin & Williams, 2015; Madera, 2016; Shahali et al., 2015). More importantly, there were no studies that focused on why some rural elementary and middle-grade teachers were better able to integrate STEM career-related lessons during science instruction than others. I thus determined that researchers and practitioners need a better understanding of rural elementary and middle-grade teachers' intentions with integrating STEM career-related lessons during science instruction because a gap remained in this area despite increased studies on integrating STEM career-related lessons in rural communities. This study could help provide answers to why rural elementary and middle-grade teachers were unable to integrate STEM career-related lessons or what experiences increased teachers' proficiency in integrating STEM career-related lessons during science instruction.

The purpose of this study was to understand how intentions impact rural elementary and middle-grade teachers' ability to integrate STEM career-related lessons during science instruction. I used a qualitative transcendental phenomenological approach to interview rural elementary and middle-grade teachers in one state in the southeastern United States. The interviews focused on the intentions, beliefs, and influence from subjective norms, perceived capability, perceived enablers, and barriers to integrating STEM career-related lessons during science instruction.

I have organized the literature review for Chapter 2 as follows. I begin Chapter 2 with a discussion of my literature search strategy. Next, I synthesize literature related to Ajzen's (1988) theory of planned behavior. Then, I provide an exhaustive review of literature related to STEM integration, integrating STEM career-related lessons, localized professional development, and phenomenology. I close with a summary of reviewed literature.

Literature Search Strategy

I used a multi-step search strategy to locate appropriate scholarly, peer-reviewed articles for this study. One search strategy included using the online Walden University Library to access scholarly databases including Academic Search Complete, ERIC, Education Research Complete, Education Source, Expanded Academic, Teacher Reference, PsycArticles, and PsycINFO. I conducted keyword searches in these databases using the follow search terms: *STEM careers, STEM integration, teachers' perceptions, science instruction, elementary science, elementary STEM, middle-grades STEM,* and *middle-grades science*. I limited these searches to texts published from 2012 through 2018. An exception was made to include articles with publication dates earlier than 2012 to provide background for the phenomenological method. I used this same exception to locate background literature in support of the conceptual framework.

As a result of these searchers, I identified the need to locate additional articles because articles related to teachers' integration of STEM careers-related content and elementary and middle-grade teachers' perceptions of STEM, in general, were limited. For example, a search for the Boolean phrase *rural teachers AND STEM integration* produced zero results in Education Source and ERIC, and only 36 results in LearnTechHub, with less than 10 applicable to this study. Exact article search was based on articles cited in articles I found previously. Despite this inclusion, finding relevant peer-reviewed articles related to elementary and middle-grade teachers' integrating of STEM career-related lessons during science instruction was problematic. Thus, I included literature on rural high school teachers' perceptions of integrating STEM and international studies. However, I include only those studies reporting findings from similar geographical areas.

Theoretical Framework

Ajzen's (1988) theory of planned behavior served as the theoretical framework for this study. Ajzen posited that behaviors are grounded in intentions, a term derived from Husserl's (1931) intentionality theory. Kockelmans (1967) simplified Husserl's intentionality theory, noting that once the mind orients to an object, then the mind intentionally allows the object to exist. For example, once teachers' minds orient to STEM, the teachers' minds intentionally allow STEM to exist. As I understood the theory of planned behavior, I also had to figure out what represented the concept of intentional acts.

Husserl (1931) perceived objects as an intentional act. An intentional act is a deliberate act. From this perception, Husserl declared the deliberate act was to be judged, assigned value, and wished into intentional acts or concepts. The concept of intentionality based on intentional relationship includes the act of consciousness and the object of consciousness as described by Husserl. Husserl affirmed that judgment is included in this understanding of consciousness. To further analyze consciousness, I needed to understand its definition.

Kockelmans (1967 as cited in Moustakas, 1994) defined consciousness as "the going-out-of-itself" (p. 36). Christensen, Welch, and Barr (2017) noted that "conscious human experiences were experiences of the world, and it is the world that gave meaning to these experiences" (p. 113). Smith (1981 as cited in Moustakas, 1994) indicated consciousness is filtered as objectifying and non-objectifying acts. Objectifying acts refer to intentional acts; while, non-objectifying acts represent feeling acts (Moustakas, 1994,

p. 29). A real world example would be teachers' intentions of integrating STEM career-related lessons during science instruction in the elementary and middle grades with a feeling of obligation. Teachers' intentions of integrating STEM career-related lessons during science instruction in the elementary and middle grades would remain even after the disappearance of the feeling of obligation (Smith, 1981 as cited in Moustakas, 1994). The transcendental phenomenology concepts of objectifying and non-objectifying acts are proceeded by the concepts of noema and noesis.

I needed to view noema and noesis to understand transcendental phenomenology. According to Moustakas (1994), noema represents the object of the phenomenon of the study. Noesis refers to the mental orientation to learning or the social phenomenon (Sheehan, 2014). Moustakas (1994) indicated that intentionality consists of a noema and noesis. Husserl (1977) noted that noema was perceived intention; while, noesis was the self-evidence. Husserl advocated that noema and noesis were fundamentally interrelated.

The theory of planned behavior was premised on the interrelations of noema and noesis, with intention as its root (Ajzen, 1988 &1991; Moustakas, 1994). Also, the planned behavior theory extends the theory of reasoned action (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975). The theory of reasoned action holds that behavioral intentions coexist with the likelihood that performance of a particular behavior leads to the desired result (Madden, Ellen, & Ajzen, 1992). Ajzen (1988) posited that behaviors predict, explain, and change by looking at an individual's intentions to perform a particular behavior (Ajzen, 1988, 1991; Doll & Ajzen, 1992; Ajzen & Fishbein, 1980; Fishbein &

Ajzen, 1975). Moustakas (1994) indicated behaviors could be viewed in terms of noema and noesis.

Within the theory of planned behavior, the noema would be the intention to perform the behavior; while the noesis would be the actual performance of the action (Ajzen, 1988 & 1991). For example, teachers' intention to integrate STEM career-related lessons during science instruction in the elementary and middle grades would be the noema; while, the actual integrating of STEM careers would be the noesis. Ajzen noted that intentions involve the factors that motivate one to perform the behavior. Stronger intentions link to a higher probability of performing the behavior. A behavior could be teachers' integration of STEM career-related content during science instruction in the elementary and middle grades. Ajzen linked lower intentions to a lower probability of performing the behavior.

These intentions result from one's perceived capability to perform the behaviors. Ajzen (1988) emphasized that stronger and lower intentions are contingent upon the individual's perception of capability in performing the behavior. Capability can be defined as one's perception of ability to perform a particular task (Conner & Armitage, 1998). For example, teachers' abilities to integrate STEM career-related lessons during science instruction in the elementary and middle grades would be measured by the teachers' level of capability. Those with higher perceived levels of capability would be inclined to persevere longer through obstacles to perform a given task, while those with lower perceived levels of capability would be less inclined to persevere through any obstacles to perform the task (Conner & Armitage, 1998).

The contingency of capability, however, is not the only contingency of the theory of planned behavior (Ajzen, 1988 & 1991). Capability was the only contingency I examined, since it is the central contingency in the component of the theory of planned behavior I used in this study. Additional contingencies of the theory of planned behavior were compatibility, stability, and accessibility (Conner & Armitage, 1998). I assessed each contingency further in the first theoretical propositions of the theory of planned behavior. Ajzen postulated that intentions could be swayed based on attitude, subjective norms, and perceived behavioral control.

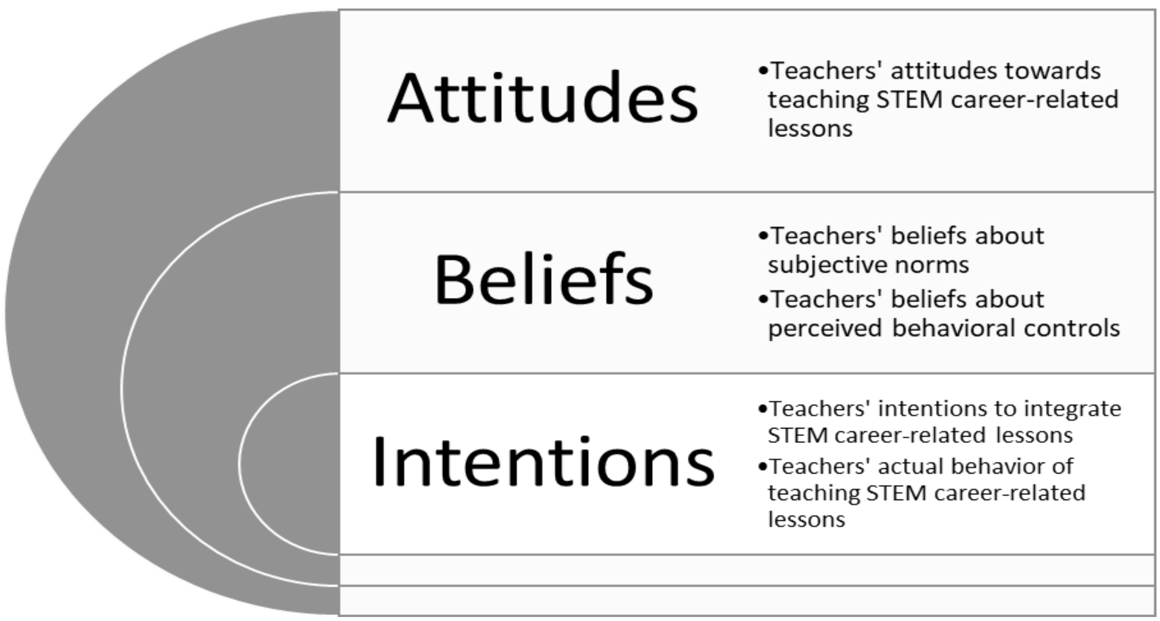

Figure 1. Theory of planned behavior.

As illustrated in Figure 1, attitude was the first major theoretical proposition of the theory of planned behavior (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975). Conner and Armitage (1998) postulated that attitudes influence behaviors through intentions. However, Doll and Ajzen (1992) believed that attitudes developed from the salient beliefs an individual has towards an object. Although the researchers demonstrated different perspectives, both researchers agreed attitude was subjective to compatibility. The contingency within the concept of attitude was compatibility (Conner & Armitage, 1998).

The contingency of compatibility arose when the belief was linked to a particular outcome and assigned a value (Doll & Ajzen, 1992; Orbell, Hodgkins, & Sheeran, 1997). According to Doll and Ajzen (1992), a behavior assigned a positive value would be evaluated favorably, whereas behaviors assigned negative values would be evaluated unfavorably. Based on the research, I predicted that teachers with positive attitudes towards integrating STEM career-related lessons during science instruction might perform the behavior. On the other hand, I expected that teachers with negative attitudes towards integrating STEM career-related lessons during science instruction might either not do the behavior or perform the behavior while unconsciously presenting students with negative or stereotypical views of STEM careers. Discussed next are subjective norms.

Subjective norms were the second major theoretical proposition of the theory of planned behavior as stated in Figure 1. Subjective norms refer to an individual's perceived social pressure to perform the behavior (Ajzen, 1985). Within this research, teachers’ perception of administrators mandating STEM career-related lesson integration or lack thereof would represent the social pressure. Application of subjective norms in the context of the study means any teacher who feels positive social pressure from administrators would be inclined to teach STEM career-related during the scheduled science instructional period. On the other hand, teachers who perceive negative social pressure from administrators would be inclined to not teach STEM career-related lesson during the scheduled science instructional period.

However, attitudes are factored into adherence to subjective norms. Attitude and subjective norms are a part of the theory of planned behavior. However, these contingencies originate from the theory of reasoned action (Madden, Ellen, & Ajzen, 1992). The theory of reasoned action has been determined to be inadequate in predicting behaviors similar to this study requiring "skills, resources, or opportunities not freely available" (Conner & Armitage, 1992). For this reason, the theory of planned behavior is believed to be a better fit to this study with its inclusion of perceived behavioral control.

As stated in Figure 1, perceived behavioral control was the last principle of the theory of planned behavior. In Figure 1, perceived behavioral control refers to the “perceived ease or difficulty of performing the behavior and is assumed to reflect past experiences as well as anticipated impediments and obstacles” (Ajzen, 1988, p. 132). According to the theoretical proposition of perceived behavioral control, beliefs regarding whether one has the needed resources and opportunities is judged against one’s capability to perform the behavior as proclaimed by Ajzen. These beliefs can be altered based on factors likely to influence one’s capability to perform the behavior (Conner & Armitage, 1992). Application of the theory of planned behavior (Ajzen, 1988) in mannerisms similar to this study appear to support the theoretical framework for the study.

Evidence in support of the theoretical framework for the study was found in Lin and Williams’ (2015) study. Lin and Williams (2015) surveyed 139 Taiwanese pre-service teachers to explore knowledge, values, attitudes, subjective norms and perceived behavioral towards intent to engage in STEM education. Lin and Williams (2015) found that higher reported levels of perceived behavioral control and subjective norms led to direct effects of stronger STEM lesson integrating intent. Indirectly, the authors found that increased knowledge and positive attitude correlated with higher subjective norms and perceived behavioral control. Though indirectly, the authors indicated that increased knowledge and positive attitude were also linked to stronger STEM lesson integrating intent.

Another example in support of the study's theoretical framework was found in a study conducted by Shahali et al. (2015). Shahali et al. (2015) investigated the effects of a short-term professional development. Shahali et al. (2015) assessed these effects on 35 STEM facilitators' abilities, efficacies, attitudes, and beliefs on integrating lessons on STEM. The findings of Shahali et al. (2015) study were that the teachers' beliefs held about integrating integrated STEM correlated to knowledge and attitude. Furthermore, the researchers contended short-term professional developments could have positive influences on these elements as mentioned above.

In an additional study, similar support in favor of the theoretical framework was apparent. Madera (2016) conducted a pilot case study comparing the beliefs, subjective norms, and culture at an urban public school and a suburban private school. Madera (2016) found similarities in attitudes towards STEM among the two teachers. Different, however, were Madera's (2016) findings on the studied teachers' perceptions of subjective norms and perceived behavioral control. In comparison, the sub-urban private school middle grade teacher expressed more freedom within the school culture to focus on STEM. On the other hand, the urban public school middle grade teacher reported more pressure from the subjective norms to engage in non-STEM activities. The rationale for selection of the theory of planned behavior as the theoretical framework of this study was the central focus on intention. The intention aspect of the theory of planned behavior assists with the alignment of the transcendental phenomenological approach with a gap in the literature.

The theory of planned behavior relates to the study because it insinuates underlying conscious attitudes might influence teachers' intention of integrating STEM career-related lessons during science instruction (Ajzen, 1988 & 1991). Now embedded in the research questions and theoretical framework are teachers' attitudes might influence the intention of integrating STEM career-related lessons during science instruction. Researchers indicated teachers’ negative attitudes towards integrating STEM career-related lessons resulted from several barriers (Dailay, 2013; Gomez & Albrecht, 2014; Nadelson, Callahan, & Pyke, 2013; Opperman, 2015; Owens, 2014; Turner, 2013; & Wang, 2012). These barriers included the level of comfort with STEM implementation, different perceptions of STEM education based on prior experiences, and a need for professional development based on Dailay, Gomez, and Albrecht; Nadelson, Callahan, and Pyke; Opperman; Owens; Turner; and Wang. However, additional needs were still found to exist.

There were needs for additional data from teachers to understand the connection between the perceptions and integrating of STEM career-related lessons during science instruction at the elementary and middle-grade levels. The use of the transcendental phenomenological design and the theory of planned behavior allowed me to capture the intentions of elementary and middle-grade science teachers as it pertained to their beliefs of integrating STEM career-related lessons during science instruction at the elementary and middle-grade level as claimed by Ajzen (1988 & 1991). Also, the overarching research question- What are the intentions of elementary and middle-grade science teachers integrating STEM career-related lessons during science instruction in the elementary and middle grades?-related to the theory of planned behavior allowed for this capture of intentions. Therefore, the purpose of this study could provide a comprehensive description of how rural teachers described their intention of integrating STEM career-related lessons during science instruction at the elementary and middle-grade levels. A review of literature related to the central concepts as it relates to Ajzen's theory of planned behavior follows.

Literature Review

The literature review of the proposed study was outlined as follows. In this literature review, I analyzed research on definitions pertinent to STEM integration and theoretical constructs of STEM integration. I also analyzed rural elementary and middle-grade teachers' perceptions of STEM integration and critical studies related to adding lessons on careers to STEM integration. I also included discussions on localized professional developments and transcendental phenomenology associated literature. I concluded this chapter with a summary of literature reviewed.

Defining STEM Integration

No precise definition of STEM was found to exist. However, researchers tended to define STEM as a discipline. According to Fiorello (2013), STEM education referred to a meta-discipline whereby infused are regular curriculums with the integrating of science and mathematics and the integration of technology and engineering. Dugger (2014) echoed this definition and further called STEM a transdisciplinary subject. According to Nedelson and Seifert (2014) and McDonald (2016), STEM also referred to instructional practices and learning activities affiliated with the integrating of science, technology, engineering, and mathematics domains. The underlying theme emerging from these definitions was integration, which means integrated into the school's curriculum must be any effort of teachers to teach STEM.

STEM education, however, could be defined as the integration of a process rather than a discipline. STEM as a process involved real-world application and orientation to STEM careers. STEM integration, according to McDonald (2016), included the use of real-world connections to examine authentic problems using active integrating and learning strategies. According to Stohlmann, Moore, and Roehrig (2012), "integrated STEM education could motivate students to careers in STEM fields" (p. 32). Integration would further help STEM recruit and maintain adequate diversified student populations to STEM careers (Crippen et al., 2015; White, 2014).

Also when defining STEM, some researchers added the terms "for some" or "for all." According to McNally (2012), such terms referred to scientific literacy. The term scientific literacy was used to reference the attempt to make science comprehensible to more people. McNally's (2012) essay investigated the debate of an "All STEM for some approach" or "some STEM for all approach". The all STEM for some approach involved the acquisition of knowledge from having been taught science language using an array of science text according to McNally.

On the other hand, McNally (2012) described some STEM for all approach as the promotion of connections of science to the real-world. According to McDonald (2016), there was a need for the promotion of science to the real-world for authentic STEM instruction. Furthermore, McNally (2012) added any approach taken should present STEM as an essential tool students need for the future career goals. McNally (2012) found that an approach synthesizing both should be taken starting in the middle grades. However, other researchers like Archer et al. (2012) suggested an approach to STEM should begin in the early to middle elementary grades. Furthermore, McNally (2012) claimed a focus on engagement and recruitment would circumvent any need for educators to choose any one side.

Gomez and Albrecht (2014) took a similar stance. Gomez and Albrecht (2014) examined research conducted by the National Academies, the National Research Council, and the National Science Foundation and found teachers' translation of lessons learned to real-world applications and career-oriented examples captured and retained the interest of students. Furthermore, it was recommended that the promotion of STEM careers should include inspirational and optimistic prospects (Gomez & Albrecht, 2014). Additionally, educators should make an effort to illustrate that any student can make a difference in the world. In succinct, research results indicated a greater need to undertake measures for engagement and recruitment of elementary and middle-grade students to STEM.

In summary, definitions of STEM were centered on integration, real-world applications, engagement, and recruitment. At the heart of these definitions was career relevancy. Also, STEM had multiple contexts which needed to be articulated by the researcher. Future references to STEM implied an inclusion of integrating STEM career-related lessons and restriction to elementary and middle-grade science teachers. The history of STEM integration follows.

History of STEM Integration

STEM integration or STEM was not always in existence. In fact, the United States had to undergo several transformations before STEM was even birthed. The first such transformation was in response to Russia's 1957 Sputnik launch. Prior to Sputnik, basic science courses focused on teaching students to understand the scientific process and the human aspects of scientific development (Wissehr, Concannon, & Barrow, 2011). After the Sputnik launch, however, the United Stated amended its science curriculum to meet its perceived need for more scientists and engineers (Cavanagh, 2007; Hein, 2006; Eisenhower, 1958; Wissehr, Concannon, & Barrow, 2011).

The United States also amended the population of students teachers would target with the new science curriculum. The view post-Sputnik was science education for all was key to revitalizing the democracy (Cavanagh, 2007). As a result, Congress passed the National Defense Education Act (NEDA) in 1958, which encouraged the creation of high-quality science programs to encourage entry into scientific careers (Wissehr, Concannon, & Barrow, 2011). However, science remained a standalone subject for several decades before the next galvanization would occur. The next attempt to galvanize science education came in the form of *A Nation at Risk* (1984).

The National Commission on Excellence in Education (1984) proclaimed: "Our Nation is at risk. Our once unchallenged preeminence in commerce, industry, science, and technological innovation is being overtaken by competitors throughout the world." (National Commission on Excellence in Education, 1984, p. 5). This proclamation shed light on a growing dilemma with the United States' schooling system (Good, 2010). The dilemma, according to Friedman (2005) was, "The American education system from kindergarten through twelfth grade just was not stimulating enough for young people to want to go into science, math, and engineering" (p. 270). Friedman (2005) continued by stating: "Because it takes fifteen years to create a scientist or advanced engineer, starting from when that young man or woman first got hooked on science and math in elementary school, we should be embarking on an all-hands-on deck, no-holds barred, crash program for science and engineering education immediately" (p. 275).

Friedman's (2005) *The World is Flat* publication led to a domino effect in science education where the course of action was immediate. For starters, President Bush's No Child Left Behind Act was dismantled and President Obama's Race to the Top was embraced. President Johnson's Elementary and Secondary School Act of 1965 was abolished and replaced with the current Every Child Succeeds Act. It was with the passage of this latter Act that the 1990s created STEM acronym was finally married to the science curriculum. An examination of the theoretical constructs of STEM integration from the perspectives of elementary and middle-grade teachers follows.

Theoretical Constructs of STEM Integration

An examination of theoretical constructs related to STEM integration from the perspectives of elementary and middle-grade teachers was conducted from current literature. A review of key literature related to elementary and middle-grade teachers' integration of STEM found evidence of the three constructs of Ajzen's (1988, 1991) theory of planned behavior. These three constructs include attitude, subjective norms, and perceived behavioral controls (Ajzen, 1988, 1991). These three constructs are then examined in terms of researchers' application to elementary and middle-grade teachers' perceptions of STEM integration. An examination of how researchers applied these theoretical constructs to research related to elementary and middle grades teachers' perceptions of STEM integration follows.

Elementary Grades' Teachers' Perceptions of STEM Integration

In this section is an examination of how researchers have applied the theoretical constructs of Ajzen's (1988, 1991) theory of planned behavior to elementary teachers' perceptions of STEM integration. Literature was examined using the constructs of attitude, subjective norms, and perceived behavioral controls (Ajzen, 1988, 1991). I first explore the construct of attitude. Attitudes are developed from salient beliefs an individual has towards an object and influences behaviors through intentions (Ajzen & Fishbein, 1980; Conner & Armitage, 1998; Doll & Ajzen, 1992; Fishbein & Ajzen, 1975). In regards to current research, elementary grade teachers' attitudes towards STEM integration are mixed.

Attitude. Evidence of elementary grade teachers' mixed attitudes towards STEM integration follow. For instance, Madden, Beyers, and O'Brien (2016) reported 100% of the 73 pre-service and early career elementary teachers studied reported positive attitudes towards the importance of STEM integration at the elementary level. In contrast, the majority of additional studies' findings identified barriers preventing adequate STEM integration. For example, Thompson and Nietfield (2016) conducted a mixed-methods study involving 132 elementary teachers from nine North Carolina public schools to investigate the translation of teachers' belief systems and educators and science content knowledge into the teachers' science classroom practices. A significant finding of the studied teachers was a lack of resources and professional development for adequate STEM integration (Thompson & Nietfield, 2016). Thomas (2014) yielded similar conclusions in an investigation of elementary teachers' attitudes towards STEM integration. An analysis of Thomas's (2014) study data found positive correlations between the dependent variables of attitude and behavior intentions and independent variables of perceived school-based support and practicality. Thomas (2014) found negative correlations between the dependent variables in regards to studied teachers' perceived barriers. Overall, Thomas (2014) found elementary teachers had an initial positive receptivity to integrating STEM in elementary classrooms despite perceived barriers. In addition, the author found that teachers' receptivity to integrating STEM in elementary classroom was dependent on other factors.

One such factor was capability. Owens's (2014) descriptive case study of 20 participants used Bandura's (2001) social cognitive theory to investigate how the actions, thoughts, and feelings a person could control were dependent on perceptions of capability. Evidence of Owens's (2014) study of capability as a contingency was manifested in the study's dissemination of results of participants' answers to questions regarding elementary teachers understanding of elementary level STEM education, self-evaluation of capability to teach STEM and its effect on STEM integration in their classrooms, descriptions of STEM education training and preparation, and perceived obstacles. In an analysis of result findings, the research disclosed that 75% of respondents were uncomfortable integrating STEM citing feelings of inadequate preparedness. Also, teachers were unsure of how STEM integration should take place in grades K-5.

Another factor was beliefs. Sias et al. (2017) examined 39 elementary teachers' generated STEM lesson plans to investigate the extent teacher's integrated educational innovations. Sias et al. (2017) found teachers must believe in the curriculum change before its integration. The study also suggested a need for more support and professional development if teachers were to consider adding educational innovations to STEM lesson plans. In succinct, researchers found that needed to formulate positive attitudes towards STEM integration were an understanding of STEM concepts, confidence and comfort, STEM preparation and training, and strategies to overcome challenges and obstacles. An examination of Ajzen's (1988) theory of planned behavior construct of subjective norms follows.

Subjective norms. Ajzen (1988, 1991) defines subjective norms as perceived societal pressure to perform a particular behavior. Within this research, a school culture that mandates STEM implementation or a lack thereof could be one representation of social pressure. For example, Martin's (2016) case study investigated 14 STEM-focused elementary school teachers' practices deemed relevant to STEM integrating and learning. The studied teachers claimed to integrate STEM into other core subjects more than other California teachers but felt less prepared to teach English/Language Arts, math, and social studies. Additionally, Martin (2016) reported that studied teachers provided more minutes of hands-on science instruction that their Californian counterparts at non-STEM focused schools. The results from the supplemental interview revealed studied teachers advocated for project-based learning, student collaboration, student choice, out of school STEM experiences, and aiding students in the development of a STEM identity. STEM identity was defined by Martin (2016) as the degree a student perceived self as confident and competent in a discipline within STEM (as cited by Paulger, 2015). Furthermore, teachers reported being more inclined to foster and promote the STEM identity of currently underrepresented groups in the STEM fields. A practice that McNally (2012) would view as the "some STEM for all approach" since students were afforded opportunities to engage in scientific discussions with guest speakers currently in STEM fields and on STEM-related field trips. Additionally, teachers encouraged students' participation in career days and science fairs similar to what Owens (2014) and Miller (2015) recommended. Teachers also stated the need for a clear vision of STEM, collaboration, community partnerships, and professional development.

Another representation of social pressure to perform a particular behavior would be in the form of peer pressure. For instance, in Opperman's (2015) study of elementary teachers' beliefs and knowledge of committing to actively integrating science and engineering, three self-contained elementary teachers and a grade 4 science teacher assessed their own beliefs in their Collaborative Conversations in STEM group. Through the use of a professional learning community, in which Opperman (2015) was a part, it was discovered no single experience transformed the commitment of the research participants to teach science and engineering actively. Although findings indicated professional development opportunities were influential, the ongoing conversations discussing strategies to implement Next Generation Science Standards before approval to conduct research threaten the validity of the results.

Opperman (2015) referred to the lessened ability of transferability to other teachers who may equally be actively committed to integrating any aspect of STEM. However, additional concerns of validity were also found. Concerns of validity also raised the fact that while others attended the Collaborative Conversations in STEM group from, as Opperman (2015) stated, "time to time" there was no mention of these less frequent attending teachers in the reported data. A more definitive accounting of the amount of time non-included teachers spent in the Collaborative Conversations in STEM group could have strengthened this study. Thus, readers were left to ponder whether different findings would have resulted. Still, a strength of this study was the examination of collaboration that the researcher indicated the studied teachers needed and a look into an actual STEM team that Owens (2014) presented as emerging themes from the findings.

In summary, current literature provided evidence of the influence of subjective norms on elementary grade teachers' perceptions of STEM integration. In current literature, the subjective norms were suggested as being from administrator and peer pressure. Administrator and peer pressure were subjective norms that influenced elementary grade teachers' perceptions of STEM integration. When elementary teachers felt little to no pressure from administrators and peers, it was likely STEM integration will not occur. However, when elementary teachers felt heavy pressure from administrators and peers, it was likely STEM integration would occur as seen in the literature discussed. A review of the literature on elementary grade teachers' perceptions of STEM integration as it related to perceived behavioral controls follows.

Perceived behavioral controls. Perceived behavioral control refers to the "perceived ease or difficulty of performing the behavior and is assumed to reflect past experiences as well as anticipated impediments and obstacles" (Ajzen, 1988, p. 132). According to the theoretical proposition of perceived behavioral control, beliefs regarding whether one has the needed resources and opportunities is judged against the capability to perform the behavior as proclaimed by Ajzen. A review of the literature found Ajzen's (1988, 1991) construct of perceived behavioral control was investigated through Bandura's (1997) self-efficacy theory. For example, Prentiss Bennett (2016) investigated 137 elementary teachers' self-efficacy to teach integrated STEM.

As cited by Prentiss Bennett (2016): "self-efficacy referred to 'beliefs in one's capabilities to organize and execute the courses of actions required to produce given attainments'" (as cited in Bandura, 1997, p. 3). Also, conducted within Prentiss Bennett's study was a comparison of the elementary teachers' self-efficacy at Title 1 and non-Title 1 schools. High levels of self-efficacy were reported from the results of the quantitative aspect of this mixed-methods study. Additionally, the author found no significant differences between the self-efficacy of the elementary teachers at Title 1 versus non-Title one schools. Results of the study's open-ended qualitative question revealed the reporting of a need for more curriculum support, resources, materials, and STEM-related trainings and professional developments.

Also examining teachers' self-efficacy was Miller (2015). In Miller's (2015) mixed methods study, reviewed were 15 upper elementary faculty and 361 students among three schools in south-central Pennsylvania in search of an understanding of influences in upper elementary students' attitudes towards STEM subjects and careers. Found was teachers' efficacy had a substantial impact on teachers' instructional practices as well as directly correlating to student achievement as described by Miller. An analysis of questions related to teachers' attitudes regarding STEM and math and science teachers' efficacies revealed viewed was outcome expectancy as less significant than integrating efficacy for math and science. Additionally, reported was teachers had limited experience with STEM career awareness, STEM integration, and use of technology.

However, Conner and Armitage (1992) indicated beliefs resulting from experiences could be altered. This alteration of beliefs was based on factors likely to inhibit the capability to perform the behavior (Conner & Armitage, 1992). Researchers (Dailay, 2013; Gomez & Albrecht, 2014; Opperman, 2015; Owens, 2014; Nadelson, Callahan, & Pyke, 2013; Turner, 2013; & Wang 2012) presented barriers that could impede a teacher's integration of STEM. These barriers included level of comfort with STEM integration, different perceptions of STEM education based on prior experiences, and a need for professional development (Dailay, 2013; Gomez & Albrecht, 2014; Nadelson, Callahan, & Pyke, 2013; Opperman, 2015; Owens, 2014; Turner, 2013; & Wang, 2012). In the same sentiment, providing of professional developments, partnerships, learning opportunities, and teacher support would encourage the performance of the behavior.

Dailay's (2013) findings indicated professional development had a positive effect on improving teachers' confidence and ability. Found were several sources in synch with these outcomes. For example, the purpose of Dailey and Robinson's (2017) study was to examine changes in science teachers' perceptions of integrating and process skills after a two-year professional development. This quantitative study showed studied teachers maintained positive results one year after the professional development ended. Nadelson and Seifert (2016) administered a demographic survey to more than 500 participants, of which 57% were elementary teachers and 27% were middle-grade teachers, who attended a western United States professional development. Findings were professional developments focused on fostering behaviors that enhanced teachers' propensity to adopt an innovation, may be pathways to organizational change as, collectively over time, teacher behaviors could transform the cultural norms and practices of the organization.

Graves, Hughes, and Balagopal’s (2016) case study involving two third grade teachers and two STEM coordinators also found a professional development on horticultural-based curriculum was successful in boosting the teachers’ confidence, accessing of curriculum resources, and perceptions on the relevancy of the program to science standards. Lee, Llosa, Jiang, Haas, O’Connor, and Van Booven (2016) also provided evidence of increased pedagogical and instructional practices in their examination of a three year English Language Learner focused curriculum and professional development intervention. In Lee et al.’s (2016) quantitative research, 103 fifth grade teachers from 33 treatment schools and 116 fifth grade teachers from 33 control schools completed a researcher-developed science test. Additionally, these teachers answered a questionnaire in regards to their instructional practices at the beginning and end of the school year 1 year after the professional development concluded. Researchers reported a positive effect of the intervention on the participants’ knowledge of science and across four areas of instructional practice-integrating for understanding, inquiry-based integrating, language development, and home language.

Opperman's (2015) study also found recent professional development activities were influential. In Opperman's (2015) hermeneutic phenomenology study, teachers' perceptions of experiences that influenced their commitment to their pedagogical content knowledge of STEM integrating and learning were explored. Findings of this study suggested professional events may affect teachers’ commitment to actively integrating STEM. Parker, Abel, and Denisova (2015) conducted a mixed-methods study involving six teachers. The purpose of this study was to investigate the effects of a two-week professional development program on teachers' experiences with integrating a six-week summer school STEM program. The results were professional developments could succeed if paid was critical attention to content and active learning. Guzey, Tank, and Wang (2014) examined the effects of a professional development program focused on engineering integration and how teachers chose to implement engineering in their classrooms as a result of the professional development. Researchers found the majority of the 198 teachers in grades 3-6 from 43 schools in 17 school districts who participated in the yearlong professional development were able to effectively implement engineering design lessons as evidenced by lesson plans and student artifacts.

Webb's (2015) mixed methods study examined the effects of engineering design professional development on elementary (K-6) teachers' perceptions of self-efficacy, content, and pedagogical content knowledge to teach engineering. Results were, after the professional development, engineering teachers had gains in content, pedagogical content knowledge, and self-efficacy to teach engineering. Nadelson, Callahan, Pyke, Hay, Dance and Pfiester (2013) studied the influence of a professional development workshop on K-5 teachers' confidence, efficacy, attitude, and knowledge. Findings suggested teacher professional developments in STEM should focus on enhancing content knowledge as a way to impact teachers' practices, which could lead to introducing students to STEM at an early age. Research conducted by Mendoza-Diaz, Cox, and Adams (2013) yielded similar findings. In this mixed methods study that consisted of the administration of a Design, Engineering, and Technology (DET) survey and the interviewing of 35 elementary teachers after a week-long professional development, the researchers also recognized the importance of the pre-college years as being important in student career interest. Goodnough, Pelech, and Stordy (2014) conducted a qualitative study on primary and elementary teachers' perceptions of an effective STEM professional development. In this study, teachers cited time, collaboration opportunities, providing resources, access to technology, and administrative support as key components. Findings of this study were that teachers required professional developments to boost confidence with competence.

In addition to boosting confidence, research suggested professional developments provided experiences to alter previously held beliefs. Owens's (2014) descriptive case study, with 12 elementary teachers from two North Carolina schools, found that teachers had different perceptions of STEM education based on prior experiences. For example, Guzey, Moore, and Harwell (2016) conducted a mixed methods study of 48 grade 4-8 science teachers to examine the success of teachers in creating 20 new engineering design-based STEM curriculum units. Found were context, engineering challenge, science integration, instructional strategies, teamwork, assessment, and organization played a critical role in designing effective STEM curriculum units and strongly correlated to the overall quality of STEM units. Guzey et al. (2016), however, noted teachers needed more support in STEM integration. In Lehman, Kim, and Harris's (2014) mixed methods study examined were participants' perceptions of a STEM education partnership project in which university faculty members and elementary school teachers collaborated to develop and implement engineering design-based materials. Found were collaborations among Community of Practice participants were crucial to the success of school-based STEM education reform initiatives.

However, professional developments that offered partnerships and learning opportunities were not the only forms of aid positively effecting teachers' integration of STEM. In addition to partnerships and learning opportunities, teacher support was found by Galosy and Gillespie (2013) to have positive effects on teachers integration of STEM. In Galosy and Gillespie's (2013) mixed methods study of novice mathematics and science teachers' learning experiences in the Knowles Science Foundation 5 year integrating fellowship, evaluated were the work samples, meeting agendas, and internal evaluations of 162 fellows and 45 senior fellows. Also, administered was a survey to these same participants. Findings of this study were the growth and sustainability of teachers hinged on support teachers received in creating a content-rich professional community, pedagogical inquiry, and classroom leadership. Support in these three areas of learning opportunity was found to strengthen the fellows' perceptions of themselves as professionals capable and subsequently, committed to integrating science and mathematics in a complex and challenging way.

In summary, research on elementary teachers' perceptions of STEM integration was limited. Available literature indicated while elementary teachers may express intentions for STEM integration, attitudes may be inhibited towards STEM integration when confronted with barriers. As elementary teachers' attitudes impacted behavior and intent, his or her level of receptivity toward STEM integration in the elementary grades would diminish. Also, subjective norms could influence the receptivity of STEM integration. Elementary teachers in STEM-focused schools and peer collaboration groups would seemingly be more inclined to gravitate toward STEM integration than counterparts not subjected to such subjective norms.

Regarding perceived behavioral control, self-efficacy was found to influence whether or not elementary teachers participated in STEM integration. Elementary teachers revealed a need for community partnerships, professional development, school support, time, and collaboration to heighten their self-efficacy with STEM integration. In research scenarios, where given were professional development, partnerships, learning opportunities, and teacher support, reports of increased STEM efficiency ensued. Also, a clear vision of STEM was needed by teachers even in STEM-focused schools. Additionally, it was known from this research that teachers who believed in STEM integration typically engaged students using a hands-on approach. However, needed was more information as to if and how recruitment takes place and if these hands-on lessons were career-relevant. Now to be investigated will be research related to middle-grade teachers' perceptions of STEM integration in relationship to the theoretical constructs of Ajzen's (1988, 1991) theory of planned behavior.

Middle Grades' Teachers' Perceptions of STEM Integration

Research related to middle-grade teachers' perceptions of STEM integration was investigated. Research was examined in terms of Ajzen's (1988, 1991) theory of planned behavior. Specifically examined were the three constructs of Ajzen's (1988, 1991) theory of planned behavior as it related to middle-grade teachers' perceptions of STEM integration. Included were the constructs of attitude, subjective norms, and perceived behavioral control. Explored first is the construct of attitude.

Attitude. Much like elementary teachers, middle-grade teachers' attitudes towards STEM integration were mixed. For example, Wu-Rorrer (2015) investigated how STEM programs could be integrated into middle school career and technical education programs. One citation, Wu-Rorrer (2015), found was teachers' negative beliefs and attitudes regarding STEM was a dilemma that could stifle progression towards STEM integration. After examining strategies teachers used to integrate STEM, Kahn (2015) added colleagues' resistance to change as an attitude inhibiting STEM integration.

On the contrary, Banks (2013) case study investigating STEM integrated instructional practice and teachers' self-efficacy of five North Carolina National Board certified teachers, four of whom taught at the middle school level reflected a more positive attitude towards STEM integration. Positive attitudes were revealed in teachers' use of hands-on, project-based learning, opportunities for the students to collaborate, and invitation of guest speakers to establish the career-relevancy of lessons taught. Much like the participants in Opperman's (2015) study of elementary grade teachers, the participants of this study would not adequately reflect the attitudes of teachers not Nationally Board certified. Nor of teachers who were not yet familiarized with common workplace trends, and lacked the level of capability to integrate STEM held by the participants of this study. Subjective norms, which may or may not, also influenced middle-grade teachers' perceptions of STEM integration. Discussed are subjective norms in the next section.

Subjective norms. Lesseig, Nelson, Slavit, and Seidel (2016) exemplified Ajzen's (1988, 1991) construct of subjective norms. Lesseig, Nelson, Slavit, and Seidel

(2016) conducted a case study of 34 6-8 grade teachers from two of six middle schools in a large school district in the western United States to analyze a professional development model. Such a model involved a partnership between science, mathematics, and education university faculty, science, and math coordinators, and middle school administrators, teachers, and students. Lesseig et al. (2016) reported summer and school year experiences positively impacted teachers' perceptions of students' capacity to work through complex problems. The teachers thought the level of the challenge inherent in the DCs and the increased responsibilities they granted to students inside of these learning experiences led to greater engagement, motivation, and empowerment.

Unlike in the review of literature related to subjective norms from the perspectives of elementary teachers, studied teachers would experience societal pressure from several sources of subjective norms. Sources of subjective norms included students, administrators, and themselves. Teachers who felt societal pressure (subjective norms) to continue STEM integration from students engaged from their experiences with DCs, administrators who would continue to motivate teachers in STEM integration, and the studied teachers would now feel empowered in STEM integration. Such feelings of empowerment would have a positive influence over perceived behavioral control. A discussion into research through Ajzen's (1988, 1991) construct of perceived behavioral control follows.

Perceived behavioral control. Wu-Rorrer's (2015) research seemed to be an action plan for influencing the effects of perceived behavioral control on middle-grade teachers' STEM integration. The first step in creating successful STEM integration was to alleviate dilemmas that may stifle progression as proclaimed by Wu-Rorrer. The dilemmas Wu-Rorrer's (2015) data analysis found were a lack of administrative support, teachers' negative beliefs and attitudes regarding STEM, and non-relevant STEM lessons. Rather, found were career-relevant STEM activities, strong administrative support, delivery of personalized, project-based learning, and use of multiple technologies were needed to recruit and engage future STEM students. Another emerging theme of this study was the necessity of professional development programs. It was recommended professional development programs be allowed for collaboration, involve administration, incorporate technology, and afford practice with best real-world applicable practices. Further, it was recommended topics of professional developments be localized to address the barriers to STEM integration teachers at a specific location identified.

Banks (2013) used five North Carolina National Board certified teachers, four of whom taught at the middle school level, in this case study investigating STEM integrated instructional practice and teachers' self-efficacy. Typical instructional strategies that emerged from the analysis of this study revealed teachers' use of hands-on, project-based learning, opportunities for the students to collaborate, and invitation of guest speakers to establish the career-relevancy of lessons taught. Studied participants self-proclaimed an active commitment to integrating STEM much like those in Opperman's (2015) study. Much like the participants in Opperman's (2015) study, the participants of this study would not adequately reflect the perceptions of teachers, not Nationally Board certified, who were not yet familiarized with common workplace trends and lacked the level of capability to integrate STEM held by the participants of this study. With the use of five members, it would even be hard to generalize the findings of this study to other National Board certified teachers. Thus, a need existed for a more involved case study or longitudinal, quantitative study to create future professional developments that would assist teachers with preparing students for entry into STEM careers.

Kahn's (2015) study was also found to mimic Opperman (2015). While relying on hermeneutic phenomenology as a theoretical construct, Kahn (2015) nearly doubled Banks (2013) sample size to eight and expanded the geographical location of the participants. Unlike Banks (2013) that obtained all five members from North Carolina, Kahn (2015) used three middle-grade teachers from Texas, two from North Carolina, one from Illinois, one from Michigan, and one from California to similarly examine strategies teachers used to integrate STEM. Also, Banks studied integrated STEM standards in a courses' scope and sequence, assessment practices, benefits, and posed challenges. In regards to STEM integration strategies, the majority of respondents indicated the use of project-based learning.

However, planning for such involved trial-and-errors, Project Lead the Way and Internet searching. The investigation into the integration of STEM standards into the scope and sequence of a course revealed differences in the levels of Next Generation Science Standards used. Kahn (2015) stated that freedom from standards could help teachers more effectively integrate STEM. Analysis of results related to the assessment of STEM showed rubrics as the primary source used. Also, standardized state tests inadequately assessed STEM skills, processes, and practices.

Teachers indicated a need for students to have more opportunities to demonstrate knowledge-base. In regards to benefits of STEM integration, teachers noted problem-solving, critical thinking, and application to the real-world. Challenges presented included time consumption, colleagues' resistance to change, and a need for more administrative support. Furthermore, one recommendation of this study was an investigation of resistant middle-grade teachers to see what facilitated this resistance. Understanding the cause of resistance would help with the creation of localized professional development programs educating teachers on best practices in planning and implementing integrated STEM courses decapitating barriers teachers identified as Wu-Rorrer (2015) recommended. Also recommended for future implications for practice were opportunities for collaboration, teacher freedom in implementing and planning for STEM integration, and increased administrative support.

In summary, middle-grade teachers' reported positive attitudes and intent to integrate STEM as evidenced by high incidences of project-based learning. In contrast, middle-grade teachers reported fellow teachers' resistance to change. Similarly, incidences of subjective norms were found to be isolated. In this case, limited to one study. Subjective norms found to reflect the studied middle-grade teachers' were felt social pressure from students, peers, administrators, and themselves.

In much the same sentiment as elementary teachers, middle-grade teachers reported a need for more administrative support, collaboration, a clearer vision of STEM, and localized professional developments to heighten perceived behavioral control. Also, articulated were multiple examples of teachers who integrated STEM in their classrooms, but lessons were often not career-relevant and failed to assess the knowledge base of students. While reviewed literature showed incidences of engagement, recruitment, and career-relevancy, research was limited. More information was needed to further assess the integrating of STEM career-relevant lessons from the perspectives of middle-grade teachers. A review of key literature related to rural elementary and middle grades' teachers' perceptions of STEM integration followed.

Rural Elementary and Middle Grades' Teachers' Perceptions of STEM Integration

In search of answers to the research questions, I analyzed critical literature. My analysis of critical literature was related to rural elementary and middle-grade teachers' perceptions of STEM integration. Reviewed literature was examined in terms of several constructs. These constructs were regarding lived experiences, attitude, subjective norms, and perceived behavioral controls. I first analyzed rural elementary and middle-grade teachers' perceptions and experiences with STEM integration.

Lived experience. Rural teachers' reported perceptions and experiences with STEM integration differed. In one instance, student disengagement was described. For example, one participant, John, reported developing a mentoring program after seeing the disengagement of his middle and high school students in understanding science as a potential career (Vaughn & Saul, 2013). John's mentoring program used older students to work with younger students in hands-on science activities as reported by Vaughn and Saul (2013). Also, Vaughn and Saul (2013) used "agents of change" to describe the perceptions and experiences of the participants in their study. A responsibility one member, Anna, stated would occur even if it meant “flying under the radar” (Vaughn & Saul, 2013, p.44).

Also, rural teachers’ perceptions and experiences included isolation, underfunding, and small student body populations. According to Avery (2013), barriers rural teachers faced with isolation, underfunding, and small student populations could be, if rural teachers taught students to see the relevancy of science in their daily lives both inside and outside of school. The strategies Avery (2013) presented derive from her theory of local rural knowledge, a derivative of place-based education. The ideology of local rural knowledge was rural children obtain STEM knowledge from their daily lives. Three strategies were presented-place-based professional development programs with mentoring teachers, scaffolding real-world connected content, and pedagogy across grade and subject areas, and providing students with concrete experiences to help rural teachers assist students with making connections from science content to their daily lives.

Avery’s (2013) described strategies were prevalent in the perceptions and experiences of the remaining studies found. Additional studies reported the use of the local environment to enhance student performance, make real-world connections, and to offer student collaborations (Clark, Majumdar, Bhattachajee, and Hanks, 2015; Goodplaster et al., 2012; Vaughn & Saul, 2013. According to Goodplaster et al. (2012) teachers voiced, “having leeway in incorporating other less conventional science integrating activities that helped students see the relevance of science and promoted student interest in science and science careers” (Goodplaster et al., 2012, p. 34). Also, rural elementary and middle-grade teachers’ lived experience with STEM integration reflected different attitudes held by studied participants. Discussed in the next section is the construct of attitude.

Attitude. Compared to elementary and middle-grade teachers, rural teachers displayed similar mixed attitudes toward STEM integration in spite of added challenges. Different, however, was the type of attitude displayed. In investigating elementary and middle-grade teachers' perceptions of STEM integration, the attitude was more of receptivity. However, in the case of rural elementary and middle-grade teachers, displayed attitudes were more of responsibility, obligation, and determination. Displayed attitudes of responsibility are discussed next.

Found were displayed attitudes of responsibility in Vaughn and Saul's (2013) study. For example, Vaughn and Saul (2013) examined the reported visions and challenges of fulfilling these visions from 10 rural teachers in Idaho attending a part-time Master's graduate program. Of these 10 participants, three taught in the elementary and middle grades. The use of the phenomenological method allowed for the interviewing of participants. Additionally, a focus group discussion, a collection of student artifacts, reflective essays, and blogs were used.

As a result of this study, teachers' vision of self, students, and school emerged as themes. From the first interview, a transformation in vision was seen. For example, during the first interviews, teachers reportedly described their vision of self as being the grade level he or she taught. As more interviews were conducted, teachers began to visualize themselves as agents of change capable of transcending the rural environments in which they taught. In respect to students, an overwhelming life beyond school perspective was reported. Like John, other participants reported using the local environment to boost achievement, make real-world connections and student collaborations.

For the vision of the school, teachers reported respect, trust, and collaboration. Challenges reported include lack of resources, poor administrative support, professional developments, building mandates, and school fragility. Despite such challenges, however, teachers felt a sense of responsibility to the students and close-knit communities in which they were employed to at least attempt their visions. A strength of this study was the researchers' use of multiple sources of data to show teachers' perception growth. A weakness, however, was that no mention was made of whether or not student artifacts reflected the teachers' indicated visions.

Still, others had attitudes of obligation. As the majority of participants in found studies taught in areas where farming fueled the local economy, several studies reported connecting school curriculums with the local communities. For example, Clark, Majumdar, Bhattachajee, and Hanks (2015) used a mixed methods approach and studied 28 Louisiana middle-grade teachers who completed a two phase summer program. This summer program consisted of collaborations with university faculty, partnerships with scientists as the participants collected weather data during a field experience and learned how to establish weather stations at their home schools. The purpose of this program was to equip teachers with the support and training to empower teachers to obtain a more in-depth understanding and ownership of the environment at the regional and local levels.

However, classroom observations, student and teacher interviews, and surveys revealed disparities between the receptivity of the innovation as demonstrated by teachers' attitudes towards the program and in the level of implementation. Found was student engagement and interest had a direct impact on the level of implementation. Another disparity found was in the level of STEM literacy reported by teachers did not reflect the level of implementation. A strength of this study was it provided a hands-on, engaging, real-world experience students from agrarian backgrounds could associate with their local communities. Also, it helped to surpass the differences in socioeconomic status among students as it required no use of technology or other resources the students may or may not have at their disposal. While this study claimed to motivate underrepresented populations to pursue STEM interests and careers, this was not a question asked of students. Also, the study failed to explain if teachers, specifically those who taught all content areas, taught this program in isolation of other standards taught or if was integrated into other subject matter. Also, no mention was made of a potential follow-up professional development for those teachers who displayed low levels of implementation of this program.

In another study, an attitude of determination was found. Goodpaster, Adedokun, and Weaver (2012) studied factors related to persistence in rural STEM integrating. For this examination, Goopaster et al. (2012) used a phenomenography with six in-service Indianan high school STEM teachers. Although primarily focusing on rural teacher retention, Goodpaster et al.'s (2012) research method was a strength of this study as it revealed rich, thick descriptions researchers could use to apply to additional rural teacher related research to gain insights into the pros and cons of rural STEM integration. For instance, the subjects of the study listed the pros of integration in a rural setting included the ability to work with community members to increase student learning and heighten science interest, close teacher and teacher-administrator relationships, and small class sizes.

As a result of these pros, teachers voiced “having some leeway in incorporating other less conventional science integrating activities that helped students see the relevance of science and promoted student interest in science and science careers” (Goodplaster et al., 2012, p. 34). In contrast, the teachers cited rural students’ poor performance as challenging regarding being able to motivate and interest students in schools and STEM subjects, massive amounts of planning, lack of guidance, limited collaboration opportunities, and lack of connection to university resources as barriers as cons of rural STEM integration. Results of this study were obtained through focus group sessions as teachers participated in a two-week summer professional development aimed to aid rural STEM teachers in anticipation of teachers integrating sustainable biofuel energy into their high school curriculums. A weakness of this study was that follow-up research was not conducted to see if the participating rural STEM teachers were successful in the implementation of the studied topic. Critical literature as it related to rural elementary and middle-grade teachers’ experiences with subjective norms is discussed in the subsequent section.

Subjective norms. As with elementary and middle-grade teachers, the subjective norms rural elementary and middle-grade teachers may be exposed to included administrators, colleagues, and themselves. Unlike elementary and middle-grade teachers, Vaughn and Saul (2012) suggested administrators discouraged STEM integration with studied participants. Despite this discouragement, teachers attempted to integrate STEM in a bid to do what they envisioned as doing right by the students. Also, partnerships were subjective norms in Capobianco and Rupp's (2014) and Ertmer, Schlosser, Clase, and Adedokun (2014)'s studies. Capobianco and Rupp (2014), utilized 12 grade 5 and 11 grade 6 STEM teachers from three rural schools, two suburban schools, and an urban school ability to plan and execute engineering lessons, instructional practices, and implications for future implementations after teachers' participation in The Science Learning through Engineering Design Partnership. In this longitudinal one year quantitative study, found was a misalignment in intended and enacted lesson delivery. Also, researchers' failure to further breakdown the number of teachers representing each school demographic (i.e. rural, suburban, and urban) was a weakness of this study. A second weakness was observation data were only presented from six of the 23 teachers.

Ertmer et al. (2014) used 21 teachers who participated in a two-week summer course, Problem-based Learning in the Science and Math Classroom to examine changes in teachers' confidence and ability to use the PBL method to teach sustainable energy both before and after the program commenced. Ertmer et al. broke down the participants of this mixed methods study as being seven in-service teachers and 13 second-career pre-service teachers. The study was part of Indiana's Research Goes to School Program aimed to improve rural middle and high school teachers' delivery and designing of PBL units geared towards promoting the career and area relevance of sustainable energy to

Grades 6-12 students. Participation in the course subjected participants to the development of mini-PBL units, collaboration with guest speakers, field trips, hands-on lab experiences, gallery walks, and the designing of rubrics. Results showed increases in subject-matter knowledge, associations with PBL and high learning outcomes, knowledge of PBL, and understanding of "how to do PBL." While the lack of opportunity made available to the research subjects to practice what they learned in the classroom may have weakened the full effects of the summer professional development, the relevance of the professional development programs to localized teachers' needs strengthened this study as evidenced by the findings of this study. The findings of this study indicated that as effects of the professional development caused teachers' confidence to increase so did outcome expectancy and personal efficacy. Additionally, professional developments could affect the perceived behavioral control experienced by rural elementary and middle-grade teachers.

Perceived behavioral control. As with Wu-Rorrer's (2015), Avery (2013) suggested strategies that could influence the effects of perceived behavioral control on rural elementary, and middle-grade teachers STEM integration. Avery (2013) noted rural elementary and middle-grade teachers needed additional support with providing scaffolding real-world connected content and providing students with concrete experiences. As such, appearing in the research to be manipulated through professional developments were rural elementary and middle-grade teachers' perceptions of STEM integration. Taken was an investigation into rural elementary teachers' current professional development opportunities including differences in practices among rural and non-rural settings (Glover et al., 2016). Also, taken were professional developments possible influence on the knowledge, perceptions, and integrating practices of said individuals by Glover et al. (2016).

Glover et al. (2016) administered the Teacher Speak national survey to 268 rural and 327 non-rural teachers. Found was no difference between the professional development characteristics of the two studied subgroups. A closer examination revealed a high correlation between topics of the professional development and teachers' practices. Moreover, matters of professional developments led to increases in perceptions of gained knowledge, perceptions of the topic, and focus of topic during instruction. Signified was time involved in the professional development by the participants as a major factor in enhancement of knowledge.

Also, investigated was the enhancement of knowledge in Clark, Majumdar, Bhattachajee, and Hanks's study (2015). In this summer program, intended was teachers' development of a thorough understanding and ownership of the environment at multiple levels. Instead, professional developments were found to not be not cure-alls as evidenced by the discrepancies when compared were teachers' implementation and students' engagement. Similarly, Capobianco and Rupp (2014) reported a misalignment between teachers' intended and actual delivery of engineering lessons. Unlike Capobianco and Rupp (2014) and Clark et al. (2015), Ertmer et al.'s (2014) study involved a professional development centered on the localized needs of the studied participants. As a result, readers were left to ponder the success of the participants in

Ertmer et al.’s (2014) study once the teachers began implementing PBLs in the classroom as they promoted the career and area relevance of sustainable energy.

In summary, literature related to rural teachers’ perceptions of STEM integration was limited. In found literature, rural teachers described many of the same barriers (i.e. need for collaboration, community partnerships, administrative support, and professional development programs) to STEM integration as suburban and urban counterparts. Despite these obstacles, rural teachers’ with strong intentions and positive attitudes towards STEM integration persevered longer to achieve their outcome. Other teachers with lower intentions and negative attitudes towards STEM integration due to unpreparedness, resistance to change, and low levels of comfort with STEM found opportunities to collaborate with others, localized professional development programs, increased administrative support, and community partnerships of benefit. Of the barriers indicated, the need for professional development was a common theme of all subgroups.

Additionally, career relevancy was a term that appeared in studies involving both elementary and middle-grade teachers, in general, and rural teachers. However, research that specifically studied career-related STEM integration was insufficient. Existing research on this study has primarily studied the perceptions of high school teachers and students. Although, a gap in literature existed for all elementary and middle-grade teachers, I chose a restriction limiting the scope of the research to rural elementary and middle-grade teachers. A review of key literature related to adding careers to STEM integration follows.

Adding Careers to STEM Integration

Additionally, my search for answers related to the research questions deemed worthy an examination of key literature related to adding careers to STEM integration. Critical literature was analyzed as it related to the viewpoint of rural elementary and middle-grade teachers. Found was a gap in the literature. In an attempt to get a general understanding of teachers' perceptions of adding careers to STEM integration, it was necessary to include articles from the viewpoint of non-rural elementary and middle-grade teachers (i.e. suburban and urban science teachers and high school teachers) and international studies. Rural elementary and middle-grade teachers' perceptions of responsibility were examined through a review of current literature.

Teachers' Perception of Responsibility. To understand the viewpoint of teachers adding careers to STEM integration, we were to first understand who this subgroup identified as responsible for integrating STEM career-related lessons to students. Such an understanding was sought by Carrico, Murzi, and Matusovich (2016). Carrico et al. (2016) used a mixed method approach to explore and compare rural Virginia and Tennessee students and educators' perceptions of STEM career decision influencers. For this exploration, researchers interviewed 24 students in Virginia and 27 students in Tennessee. In relations to the number of educators' used, a weakness of the study was that it simply reported 31 respondents that included high school teachers, guidance counselors, county administrative staff, and principals. A reporting of the specific number of teachers engaged in the interviews would have strengthened the study. While this study did gauge the perceptions of students and educators, it was only the perceptions of the educators that were of value to the research study. Or, in this case, educational stakeholders, as there was no way to tell how many educators were involved in this study. An online questionnaire comprised of Likert-scale and open-ended questions was administrated to explore perceptions of knowledge of STEM careers, school and region-related STEM activities, and identification and role of STEM career decision influencers to fulfill the purpose of this study. Although identified were teachers as influencing students' STEM career paths, teachers named First Robotics, Project Lead the Way, and the Technology Student Association, but overwhelming stated unfamiliarity with such programs or that such programs were unavailable at their schools.

Although the researchers did not attempt to account for this discrepancy in their research, these results aligned with the high percentages of teachers indicating possession of little confidence with STEM careers. Carrico et al. (2016) reported as high as three times as more females reported having little confidence with discussing STEM careers. Thus, it was not surprising for respondents to report outreach activities as being the most influential on STEM career decisions. About perceived barriers to students' pursuit of a STEM career, highly reported was a need for increased STEM career exposure. Absent from these findings were recommendations, from educators' perspectives, as to how to increase educators' knowledge of STEM careers.

Unlike the participants in Carrico et al.'s (2016) study, teachers in Watermeyer, Morton, and Collins's (2016) study were more aware of their role in promoting students' STEM career awareness. In this mixed method study, Watermeyer et al. (2016) collected data from 94 completed online surveys across 223 secondary schools in Wales.

Respondents were found to have an explicit link between their roles as science teachers and their roles as ambassadors for STEM-based careers. Differing among respondents was the level respondents perceived they should promote STEM-based careers. Opinions, reported by Watermeyer et al., varied from respondents being the sole provider of STEM-based career guidance to merely orienting students to STEM-based careers. Alternatively, five respondents did not feel STEM-based career guidance was their responsibility at all. Furthermore, Watermeyer et al. (2016) described student disengagement, prior experiences of studied teachers, limited capacity, scarce resources, lack of access to resources, and lack of support as barriers inhibiting STEM-based career guidance.

Observed were similar results in a study conducted by Cohen, Patterson, Kovarik, and Chowning (2013). In this mixed methods study, 70 high school science teachers and other science educators engaged in formal and informal interviews, focus groups, and open-ended survey questions. The purpose of this study was to investigate how high school students were made aware of STEM career options, how educators could help students in their pursuit of STEM careers, and how to provide support and skills students needed to succeed in their pursuit of STEM careers. Found was students needed adults knowledgeable of STEM careers so connections between students' interests, classroom lessons, and real-world applications could be apparent. Studied teachers, however, expressed similar views as those in Watermeyer et al.'s (2016) study.

Reported was teachers lacked an awareness of STEM career options. Also, teachers reported a lack of pedagogical strategies and resources needed to add careers to their STEM integrated lessons. Like Watermeyer et al.'s (2016) participants, additional teachers reported not viewing the addition of careers to STEM integration as part of their responsibility as a science teacher. Despite the large sample size of the study strengthening the transferability of the study, the lack of clarification as to what is meant by "other science educators" was a weakness. In spite of this weakness, the authors noted teachers' need for community support in integrating STEM career-related lessons to students.

As a result of a review of available literature known was an assumption exists that teachers have an influential role in integrating STEM career-related lessons (Nadelson & Seifert, 2013; Stubbs & Myers, 2015; Tuijl & Mohen, 2016). Based on an analysis of teachers' perceived responsibility in integrating STEM career-related lessons, resulting consequences appeared. Seeking to know such consequences of integrating STEM career-related lessons was the purpose of Reiss and Mujtaba's (2017) study. In Table 1, eight recommendations were depicted from Reiss and Mujtaba's examination of the ASPIRES and UPMAP projects.

Table 1

Recommendations for Embedded Career STEM Integration

Step	Recommendations
1	Teachers need to embed careers into STEM integration to a larger extent.
2	Embedding STEM integration need focus on information, advice, and guidance.
3	Teachers need to teach students a goal to possess a STEM career is attainable.
4	Teachers need to teach the usefulness of STEM subjects.
5	Teachers need to teach students STEM careers are worthwhile and should make students believe in their future success in a STEM career.
6	Teachers need to teach the usefulness of STEM subjects.
7	Teachers need to teach the possibilities of STEM careers.
8	Teachers need to teach the transferability of STEM subjects.

To arrive at this information, Reiss and Mujtaba (2017) examined two projects- ASPIRES and UPMAP. According to Reiss and Mujtaba (2017), the ASPIRES project examined explorations and engagement in science in 10-14-year-old students. Through the use of 9319 quantitative online surveys and interviews with students and parents, examined were science career aspirations, school science attitude, self-efficacy in science ability, perceptions of scientists, and outside science activity participation. Also, studied were parental expectations, parents' perceptions of science, peer attitudes toward science and school in three phrases. Results of this study were 15% of studied students wanted careers as scientists. Furthermore, found was science capital, a resource enabling individuals to feel confident about science and desire to assess it, had a greater influence on the studied students than parents as a subjective norm did.

The UPMAP (Understanding Participation rates in post-16 Mathematics and Physics) project sought to determine factors that would enhance students' pursuit of mathematics and physics after age 16 according to Reiss and Mujtaba. Three strands were used to determine these proposed factors. Unlike the ASPIRES project which used different age ranges as its phases; UPMAP, on the other hand, organized its strands around concepts. In Strand 1, engagement and disengagement were explored using a total of 23, 000 student questionnaires and questionnaires from teachers from 141 United Kingdom schools. Unknown from analysis of this body of literature was the actual number of teachers involved in answering the questionnaires, a specific number of teachers integrating the studied subjects of math and physics, and the number of teachers representing year 8 and year ten grades.

Strand 2 entailed an investigation of subjectivities and school culture. For this investigation, examined were the role of key influencers of subject choice, outside school experiences' influence, nature of students' understanding of math, physics, and English, and perceptions of math, physics, and English abilities and subsequent correlations. Such examination was through continued work with Strand 1 schools and semi-structured interviews with six now aged 15, 16, and 17-year-old students at each of the 12 Strand 1 schools. In Strand 3, documented were the students of Strand 1 rationale for higher education study selection. During this stage, conducted were narrative interviews with 51 first year undergraduates younger than age 21 at four higher education schools were conducted. The purpose of this Strand's research was to explore studied participants experiences and feelings in regards to educational choice, family, and decision-making process. Cited was a disclosure of studied teachers' lack of STEM career knowledge. Further analysis of this study resulted in the emergence of positive and negative consequences associated with integrating STEM career-related lessons. Discussed first are positive consequences of integrating STEM career-related lessons.

Positive consequences of integrating STEM career-related lessons. According to Reiss and Mujtaba (2017), positive consequences of integrating STEM career-related lessons ensued once taught was the career relevancy of science during science instruction. When teachers acted as surrogate ambassadors for STEM careers, found were higher probabilities of students continuing a pursuit of a STEM career after age 16 (Reiss and Mujtaba,2017; Watermeyer et al., 2016). Furthermore, Reiss and Mujtaba (2017) indicated teachers making young people more aware of the transferability of science to

STEM careers would compensate for the limited science capital of students and their families. Heightening awareness, however, required teachers to possess positive attitudes towards integrating STEM career-related lessons. Stubbs and Myers (2015) indicated teachers' positive attitudes and efficient integrating of STEM would have positive impacts on students' perceptions of STEM. In the same sense, increasing the amount of STEM-related training through professional developments would have positive effects on teachers' integrating of STEM at more advanced levels.

Negative consequences of integrating STEM career-related lessons. On the other hand, negative attitudes towards integrating STEM career-related lessons could result in negative consequences (Wu-Rorrer, 2015). One negative consequence, Reiss and Mujtaba (2017) noted was teachers might unconsciously and without intent relay out-of-date or stereotyped information to students. Researchers indicated teachers' negative attitudes towards integrating STEM career-related lessons might be the result of several factors (Carrico et al., 2016; Dailay, 2013; Gomez & Albrecht, 2014; Miller, 2015; Nadelson, Callahan, & Pyke, 2013; Opperman, 2015; Owens, 2014; Turner, 2013; & Wang, 2012; Watermeyer et al., 2016). These factors included the level of comfort with integrating STEM career-related lessons, different perceptions of STEM careers based on prior experiences, and a need for professional development based on Carrico; Dailay, Gomez and Albrecht; Nadelson, Callahan, and Pyke; Opperman; Owens; Turner; Wang; and Watermeyer et al. Consequently, affected students may exclude STEM career options prematurely (Tuijl & Mohen, 2016).

Kahn (2015) added teachers' resistance to change may also result in negative consequences. As Archer et al. (2012) expressed students' aspirations in STEM careers solidify by ages 10-14 and would shift little afterward. As a result of teachers, resistance to integrating STEM career-related lessons, rural elementary and middle-grade science teachers might never expose students to or inspire students to pursue STEM careers (Avery and Reeve, 2013; Turner, 2013). Additional information was needed from rural elementary and middle-grade science teachers to improve any negative attitudes had to prevent negative consequences of integrating STEM career-related lessons. With the absence of significant studies on rural elementary and middle teachers' perceptions of integrating STEM career-related lessons, teachers' intentions of integrating STEM career-related lessons during science instruction in the elementary and middle grades and how such intentions might influence science instruction was unknown.

As Ajzen (1988) theory of planned behavior postulates intention is grounded in attitude, subjective norms, and perceived behavioral control, needed is this study because rural elementary and middle-grade teachers' attitude, subjective norms, and perceived behavioral control may influence intention to integrate STEM career-related lessons during science instruction. And it may provide insight into whether rural teachers integrate STEM careers regularly, intermittently, or rarely to their elementary and middle-grade students. A potential implication for positive social change consistent with and bounded by the study was it may help inform administrators how teacher's intentions of integrating STEM career-related lessons might impact science instruction. Knowing this information may assist with the designing of localized professional developments geared toward training more teachers to engage in STEM career integrating during instruction. An examination of professional developments as it related to rural elementary and middle-grade teachers' perceptions and experiences with STEM integration follows.

Professional Development

Research investigating the effectiveness of professional developments aimed at training more teachers to engage in STEM career integrating during instruction was shown to be inconsistent with teachers who struggle with STEM integration. One reason for this inconsistency was a lack of local focus (Nadelson & Seifert, 2013). Miles, van Tryon, and Mensah's (2015) mixed methods study established the need for a localized professional development for rural educators. Miles et al. (2015) involved middle and high school math and science teachers from 12 North Carolina rural school districts in a TechMath professional development program. The purpose of this study was to investigate the effectiveness of the program with making teachers aware of STEM career opportunities. Teachers reported, as a result of the program, improvement in perceptions of the importance of STEM career preparation, learning how to explain the content and STEM career connections to students, increased local STEM businesses collaborations, positive changes in attitudes towards STEM careers, and increased awareness of STEM career opportunities.

However, current literature indicated a local focus was not the only factor in effective professional developments. The length of time was another factor indicated in earlier mentioned professional developments. In Curtis et al. (2017) study of 24 in-service math and science middle-grade teachers in rural Appalachia, found was the length of professional development had a significant impact on the professional development's effectiveness. As a result of the ongoing nature of the professional development, researchers were able to revamp the structure of the professional development to better address teacher named deficiencies. Compared to the professional development onset, research participants experienced transformation as they evolved from being unable to integrate STEM to results similar to what Miles et al. (2015) reported.

Also, another factor for effective professional developments was the teaching of strategies. The U. S. Department of Education, OET, (2016) suggested professional development offer effective strategies in effective integrated STEM. Entailed may be the inclusion of STEM professionals in the STEM shortage fields and training on the interconnectedness of STEM disciplines within STEM and non-STEM fields, like arts, history, and social studies. Training experiences for educators in effective strategies for providing integrated STEM education would include collaboration with researchers and STEM professionals, and explicit training in how STEM discipline-specific topics relate to or connect with other STEM and non-STEM disciplines, including social studies, art, and history (U.S. Department of Education, OET, 2016). The inclusion of these factors into professional developments would be crucial to engaging and recruiting rural students to STEM education given the lived experiences, attitudes, beliefs, subjective norms, and perceived behavioral control of existing studies on rural elementary and middle-grade teachers. Additionally, Cotabish (2013) added professional developments should take heed of teachers' concerns and expand on teachers' existing knowledge and practices. However, more information was needed from rural elementary and middle-grade teachers' perspectives to formulate a localized professional development that would address the specific needs of the studied population. Discussed now is transcendental phenomenology as a research design for this study.

Transcendental Phenomenology

The preferred research approach for this study was phenomenology. This preference was based on alignment with Ajzen's (1988, 1991) theory of planned behavior as the conceptual framework. This preference was also based on the traditional use of interviews in the phenomenological method. Phenomenology's use of interviews to gather narratives of participants lived experience would aid in the gathering of responses to the open-ended questions related to rural elementary and middle-grade teachers' intentions of integrating STEM career-related lessons during science instruction. Additionally, it would lend consistency to the stated purpose of this study.

A review of the literature found several incidences where phenomenology was used as a research method. For example, Vaughn and Saul (2013) examined the reported visions and challenges of fulfilling these visions from 10 rural teachers in Idaho attending a part-time Master's graduate program. Of these 10 participants, three taught in the elementary and middle grades. The use of the phenomenological method allowed for the interviewing of participants. Additionally, a focus group discussion, a collection of student artifacts, reflective essays, and blogs were used. As a result of this study, teachers' vision of self, students, and school emerged as themes.

From the first interview, seen was a transformation in vision. For example, during the first interviews, teachers reportedly described their vision of self as the grade level taught. As conducted were more interviews, teachers began to visualize themselves as agents of change capable of transcending the rural environments in which they taught. In respect to students, reported was an overwhelming life beyond school perspective held. Like John, other participants reported using the local environment to boost achievement, make real-world connections and student collaborations.

For the vision of the school, teachers reported respect, trust, and collaboration. Challenges reported included lack of resources, poor administrative support, professional developments, building mandates, and school fragility. Despite such challenges, however, teachers felt a sense of responsibility to the students and close-knit communities in which they were employed to at least attempt their visions. A strength of this study was the researchers' use of multiple sources of data to show teachers' perception growth. A weakness, however, was found in no mention of whether or not student artifacts reflected the teachers' indicated visions. In two additional studies, hermeneutic phenomenology was the preferred research approach.

In the first example, Opperman's (2015) explored teachers' perceptions of experiences that influenced their commitment to their pedagogical content knowledge of STEM integrating and learning. Findings of this study suggested professional events may affect teachers' commitment to actively integrating STEM. In the second example, Kahn (2015) used three middle-grade teachers from Texas, two from North Carolina, one from Illinois, one from Michigan, and one from California to similarly examine strategies teachers used to integrate STEM. Also, studied were integrated STEM standards in a courses' scope and sequence, assessment practices, benefits, and posed challenges.

In regards to STEM integration strategies, the majority of respondents indicated the use of project-based learning. However, planning for such involved trial-and-errors, Project Lead the Way and Internet searching. The investigation into the integration of STEM standards into the scope and sequence of a course revealed differences in the levels of Next Generation Science Standards used. Kahn (2015) stated that freedom from standards could help teachers more effectively integrate STEM. Analysis of results related to the assessment of STEM showed rubrics as the primary source used.

Also, standardized state tests inadequately assessed STEM skills, processes, and practices. Teachers indicated a need for students to have more opportunities to demonstrate knowledge-based. In regards to benefits of STEM integration, teachers noted problem-solving, critical thinking, and application to the real-world. Challenges presented included time consumption, colleagues’ resistance to change, and the need for more administrative support. Furthermore, one recommendation of this study was an investigation of resistant middle-grade teachers to see what facilitated this resistance. Also recommended for future implications for practice were opportunities for collaboration, teacher freedom in implementing and planning for STEM integration, and increased administrative support.

However, in this study, the specific phenomenological research type used was transcendental phenomenology. According to Sokolowski (2000), transcendental means to “go beyond” and is derived from the Latin root word transcendere (p. 58). Dealing with consciousness and objects presentation of themselves to consciousness, researchers must first adopt a phenomenological attitude (Giorgi, 2009). Adoption of a phenomenological attitude means to view everything from consciousness and to accept perceptives as participants accounted to have been experienced without the researcher questioning truth (Giorgi, 2009). It was only after the adoption of such an attitude I could search for the essence of the rural elementary and middle-grade teachers' intentions of integrating STEM career-related lessons during science instruction. Such a search was part of the phenomenological reduction, a process whereby separated were the perceiving act and positing act from that which was presented in the act of perceiving (Cerbone, 2014).

Phenomenological reduction was what Cerbone (2014) referred to as a purification process where paid was attention to the noema and noesis. Based on the findings from Moustakas (1994), noema represents the object of the phenomenon of the study. The noesis refers to the mental orientation to learning or the social phenomenon as documented by Sheehan (2014). According to Moustakas (1994), intentionality consists of a noema and noesis. Husserl (1977) denoted noema is perceived intention; while, the noesis is the self-evidence.

Husserl advocates that noema and noesis must coexist. The coexistence of noema and noesis makes the heart of the theory of planned behavior (Ajzen, 1988 &1991). Noema and noesis becomes the heart of the theory of planned behavior because intention lies at the root (Moustakas, 1994). Ajzen (1988) posits behaviors predict, explain, and change by looking at an individual's intentions to perform a particular behavior (Ajzen, 1988; Ajzen, 1991; Doll & Ajzen, 1992; Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975). Moustakas (1994) indicated behaviors could be viewed in noema and noesis.

With the theory of planned behavior, the noema is the intention to perform the behavior; while the noesis is the actual performance of the action (Ajzen, 1988 & 1991). For example, teachers' intention to integrate STEM career-related lessons during science instruction in the elementary and middle grades would be the noema; while, the actual integrating of STEM careers would be the noesis. Ajzen discusses intentions capture the factors that motivated one to perform the behavior. Stronger intentions link to a higher probability of performing the behavior as explored by Ajzen. A behavior could be teachers' integrating STEM career-related lessons during science instruction in the elementary and middle grades.

Lower intentions are linked to a lower probability of performing the behavior as examined by Ajzen. These intentions result from one's perceived capability to perform the behaviors. Both stronger and lower intentions are contingent upon the individual's perception of capability in performing the behavior as emphasized by Ajzen. This section provided a succinct explanation of the use of transcendental phenomenological method. Discussed is transcendental phenomenology in more detail in Chapter 3.

Summary

Definitions of STEM integration were centered on real-world applications, engagement, and recruitment. Career relevancy was at the heart of these definitions. Also, STEM had multiple contexts which needed to be articulated by the researcher. Future references to STEM implied an inclusion of integrating STEM career-related lessons and are restricted to elementary and middle-grade science teachers. In succinct, needed to formulate positive attitudes towards STEM integration were an understanding of STEM concepts, confidence and comfort, STEM preparation and training, and strategies to overcome challenges and obstacles. Research on elementary teachers' perceptions of STEM integration was limited.

While it was found in available literature elementary teachers may express intentions for STEM integration, attitudes towards STEM integration may be inhibited when confronted with barriers. As elementary teachers' attitudes impacted behavior and intent, his or her level of receptivity toward STEM integration in the elementary grades diminished. In addition, subjective norms could influence the receptivity of STEM integration. Elementary teachers in STEM-focused schools and peer collaboration groups would seemingly be more inclined to gravitate toward STEM integration than counterparts not subjected to such subjective norms. In terms of perceived behavioral control, self-efficacy was found to influence whether or not elementary teachers participated in STEM integration.

Elementary teachers revealed a need for community partnerships, professional development, school support, time, and collaboration to heighten their self-efficacy with STEM integration. In research scenarios where professional development, partnerships, learning opportunities, and teacher support were given, reports of increased STEM efficiency ensued. In addition, a clear vision of STEM was needed by teachers even in STEM-focused schools. Additionally, it was known from this research that teachers who believed in STEM integration typically engaged students using a hands-on approach. However, more information was needed as to if and how recruitment took place and if these hands-on lessons were career-relevant.

Middle-grade teachers' reported positive attitudes and intent to integrate STEM as evidenced by high incidences of project-based learning. In contrast, middle-grade teachers reported fellow teachers' resistance to change. Similarly, incidences of subjective norms were found to be isolated. In this case, limited to one study. Subjective norms were found to reflect the studied middle-grade teachers' felt social pressure from students, peers, administrators, and themselves.

In much the same sentiment as elementary teachers, middle-grade teachers reported a need for more administrative support, collaboration, a clearer vision of STEM, and localized professional developments to heighten perceived behavioral control. Also, articulated were multiple examples of teachers who integrated STEM in their classrooms, but whose lessons were often not career-relevant and failed to assess the knowledge base of students. While reviewed literature showed incidences of engagement, recruitment, and career-relevancy, research was limited. More information was needed to further assess the integrating of STEM career-relevant lessons from the perspectives of middle-grade teachers. However, literature related to rural teachers' perceptions of STEM integration was limited.

In found literature, rural teachers described many of the same barriers (i.e. need for collaboration, community partnerships, administrative support, and professional development programs) to STEM integration as suburban and urban counterparts. Despite these obstacles, rural teachers' with strong intentions and positive attitudes towards STEM integration would persevere longer to achieve their outcome. Other teachers with lower intentions and negative attitudes towards STEM integration due to unpreparedness, resistance to change, and low levels of comfort with STEM might find opportunities to collaborate with others, localized professional development programs, increased administrative support, and community partnerships of benefit. Of the barriers, indicated, the need for professional development was a common theme of all subgroups. Additionally, career relevancy was a term that appeared in studies involving both elementary and middle-grade teachers, in general, and rural teachers.

However, research that specifically studied career-related STEM integration was insufficient. Existing research on this study had primarily studied the perceptions of high school teachers and students. Although, a gap in literature existed for all elementary and middle-grade teachers, I chose a restriction limiting the scope of the research to rural elementary and middle-grade teachers. With the absence of significant studies on rural elementary and middle teachers' perceptions of integrating STEM career-related lessons, teachers' perceptions of integrating elementary and middle grades students to STEM careers and how such perceptions might influence science instruction was little known. As Ajzen (1988) theory of planned behavior postulates intention was grounded in attitude, subjective norms, and perceived behavioral control, needed was this study because rural elementary and middle-grade teachers' attitude, subjective norms, and perceived behavioral control might influence intention to teach STEM careers during science instruction. And it might provide insight into whether rural teachers taught STEM careers regularly, intermittently, or rarely to their elementary and middle-grade students. A potential implication for positive social change consistent with and bounded by the study was it may help inform administrators how teacher's perceptions of integrating

STEM career-related lessons might impact science instruction. Knowing this information may assist with the designing of localized professional developments geared toward training more teachers to engage in STEM career integrating during instruction.

In conclusion, the organization of the literature review for Chapter 2 was as follows. The chapter began with an introduction that restated the study's problem, purpose, and concise synopsis of the literature that established the relevance of the problem. Following the introduction was a discussion on the literature search strategy. Afterwards, literature related to Ajzen's (1988) theory of planned behavior was synthesized. Then, the researcher provided an exhaustive review of literature related to STEM integration, integrating STEM career-related lessons, localized professional developments, phenomenology and a summary of literature reviewed.

Chapter 3 presents the research method used in this study. In the chapter, the research design, rationale, and research questions were described. Also the rationale for the selection of the transcendental methodology as well as the dismissal of other considered research options are discussed. In the methodology section of this study, the role of the researcher, participant selection, and instrumentation are described. Plans for the recruitment of participants, participation, data collection, and analysis are described. Also, the issues of trustworthiness and ethical procedures related to this qualitative study are included.

Chapter 3: Research Method

The purpose of this qualitative study was to understand how intentions impact rural elementary and middle-grade teachers' integration of STEM career-related lessons into science instruction. I used a transcendental phenomenological approach in this study. Transcendental phenomenology is the study of an individual's experience through the individual's consciousness (van Manen, 2017). In this study, I defined consciousness as an individual's natural state of awareness (Cerbone, 2014). Researchers use transcendental phenomenology to find the genesis of an individual's knowledge based on the individual's conscious experiences (Jansen, 2017).

I interviewed rural elementary and middle-grade teachers in one state in the southeastern United States to understand their conscious experiences. The interviews focused on understanding teachers' firsthand accounting of intentions, beliefs, influence from subjective norms, perceived capability, perceived enablers, and barriers to integrating STEM career-related lessons during science instruction. These interviews provided insight into why rural elementary and middle-grade teachers were unable to integrate STEM career-related lessons during science instruction despite engaging in professional development. This project also helped me clarify whether rural elementary and middle-grades science teachers integrated STEM career-related lessons during science instruction regularly, intermittently, or rarely. In the last chapter, I analyzed current literature to identify the problem and gap in literature. The gap in literature led to the formation of the purpose and research questions. In Chapter 3, I provide a detailed account of the research design, methodology, role of the researcher, and ethical considerations.

Research Design and Rationale

Research Questions

I developed the following research question and subquestions to explore rural teachers' intentions of integrating STEM career-related lessons. I wanted to know the answers to the following.

RQ1: What were the intentions of rural elementary and middle-grade science teachers as it pertained to integrating STEM career-related lessons during science instruction?

SQ1: What did rural elementary and middle-grade science teachers believe about integrating STEM career-related lessons during instruction in the elementary and middle-grades?

SQ2: How do rural elementary and middle-grade science teachers describe influence from subjective norms in integrating STEM career-related lessons during science instruction to elementary and middle-grade students?

SQ3: What resources do rural elementary and middle-grade science teachers describe as impacting their participation in integrating STEM career-related lessons during science instruction to elementary and middle-grade students?

SQ4: How do rural elementary and middle-grade science teachers perceive their capability in integrating STEM career-related lessons during science instruction to elementary and middle-grade students?

These questions were aligned with the theories, themes, and key concepts I have outlined in the previous chapters.

Central Concepts and Design

The purpose of this study was to understand how intentions impact rural elementary and middle-grade teachers' actual integration of STEM career-related lessons during science instruction. The study focused on the intentions of rural elementary and middle-grade teachers in one state in the southeastern United States. A qualitative transcendental phenomenological approach was the most appropriate research method to fulfill the study's purpose and answer the research questions. Moustakas (1994) maintained that the transcendental phenomenological approach allowed researchers to determine meanings of experiences. Moustakas (1994) also noted the researcher finds the underlying meaning of these experiences by interpreting the descriptions provided by the respondents. In addition, these descriptions must be judgement-free and must be accepted in their entirety. It is for these reasons that I remained separate from this study and assumed the role of a detached observer. These characteristics were more parallel with the purpose and research questions of this study than the quantitative research method.

Maxwell (2013) defined quantitative research as the testing of theories by investigation of the relationship between variables. Quantitative researchers use statistics and facts to address what and how questions such as "how many, to what extent, or what percentage?" (Branham, 2015; Goertzen, 2017). Additionally, quantitative research lacked insight into why people's thoughts, feelings, and actions were a certain way (Goertzen, 2017, p. 12). I did not use the quantitative method because it would be more appropriate for a longitudinal study on elementary and middle-grade teachers' intentions of integrating STEM career-related lessons during science instruction. Since capturing the depth of intentions of rural elementary and middle-grade teachers as it related to integrating STEM career-related lessons during science instruction was a time-sensitive issue, it was not reasonable for me to conduct a longitudinal study at present. Therefore, I decided to use the transcendental phenomenological method.

Rationale

The transcendental phenomenological research method was more effective at fulfilling the study's purpose and providing answers to the research questions than other research methods I considered. One of these methods was case study. According to Yin (2009), researchers use a case study design when multiple sources of data are needed to present a rich, thick description of a phenomenon where the boundaries between the phenomenon and the context are unclear. Further investigation of the case study method revealed the purpose of a case study was to "catch the complexity of a single case" (Stake, 1995, p. xi). Several aspects of my research (i.e., elementary teachers, middle-grade teachers, STEM integration, and STEM career incorporation) could be considered cases in Stake's (1995) view. However, aspects such as elementary and middle-grade teachers' integrating and reasons elementary and middle-grade teachers might or might not integrate STEM career-related lessons were generalities, not cases. Therefore, I rejected the case study design because the objective of the research was to understand rural elementary and middle-grade teachers' intentions to integrate STEM career-related lessons during science instruction.

I also considered grounded theory as a research design for this study. According to Miles, Huberman, and Saldana (2014), in grounded theory research, the researcher works to develop an original theory grounded in the data collected for the study. Maxwell (2013) expanded on this definition, adding that grounded theory is an inductive development of a theory based on a study and consistent data interaction. Although patterns did emerge in the collection of data for this research, I did not intend to formulate a theory. Also, the lives of participants were not within the scope of this study, so the narrative approach was rejected (Miles, Huberman, & Saldana, 2014). The ethnography design was also rejected, since I did not wish to examine living conditions and experiences of an intact cultural group (Miles, Huberman, & Saldana, 2014). In the next section of this chapter, I identify and discuss my role and purpose as the researcher for this transcendental phenomenological research study.

Role of the Researcher

The role of a qualitative researcher is multi-faceted. My first role was that of data collector. I was an observer in this capacity since I did not interact in any of the school settings where the participants were employed. I did not have any association with any of the rural elementary and middle-grade science teachers or rural school districts I approached to recruit participants to this study. I do work in a rural elementary school setting as a self-contained Grade 3 teacher and do have contact with the rural elementary and middle-grade science teachers employed there. Because of this, I was aware of my own intentions to integrate STEM career-related lessons during science instruction and those of some of the elementary and middle-grade science teachers I worked closely with.

For this reason, I excluded the school district where I was employed, and thus excluded its rural elementary and middle-grade science teachers from participating in this study. I also used a bracketing journal to ensure my bias was withheld from this study. Merriam (2016) claimed, "It is a common practice in qualitative research for researchers to write about their own experiences of the phenomenon or to be interviewed by a colleague to "bracket" their experiences before interviewing others" (p. 93). Doing so could enable researchers to "have a more precise sense of what they are attempting to obtain" (Manen, 1990, p. 64).

Although my only interaction with research participants was by individual telephone interviews, it was still my responsibility as a researcher to ensure ethical protocols were followed during the recruitment and identification of research participants. It was also my responsibility to ensure research participants were informed of the voluntary nature of their participation and their right to withdraw at any time during data collection and analysis processes to protect participants from any harm. In addition, I emailed each volunteer participant a consent form, which I requested they electronically sign. The consent form explained my use of pseudonyms to protect participants' identities, protection of rights, and a full disclosure of what their participation in this study actually meant. The consent form also included the potential benefits of the study to help build the researcher and participant relationship. I also emailed a consent form to all of the superintendents of rural schools in one state in the southeastern United States to inform them of the nature of my study and to recruit volunteer participants. My aim with these steps was to help build a sense of trust in me and the study.

Methodology

Participant Selection Logic

The potential participants for this study were selected from the population of full-time, rural elementary and middle-grade teachers teaching science courses to students in Grades 3, 4, 5, 6, 7, or 8 in one state in the southeastern United States. I used purposeful sampling for participant selection. Purposeful sampling entails selecting participants deliberately to answer the research questions (Maxwell, 2013). Merriam and Tisdell (2016) stated, "Purposeful sampling is based on the assumption the investigator wants to discover, understand, and gain insight and therefore must select samples from which the most can be learned" (p. 96). My use of purposeful sampling allowed me to ensure all potential participants were full-time, rural elementary and middle-grade teachers that I could then randomly select from. I further ensured participants met the criteria for this study by reiterating at the onset of the interview that participants were invited to the study based on their role as a full-time science teacher in Grades 3, 4, 5, 6, 7, or 8. I also collected demographic information related to gender, race, school district employed, and grade level(s) taught to further ensure criteria were met. If at any point a research participant was determined to be ineligible to participate in the study, I thanked them for their time and advised the individual(s) that they were excluded from any further participation in the study based on the study’s criteria.

According to Merriam and Tisdell (2016), the specific number of participants were of little importance to qualitative research. The most important aspects of qualitative data collection were sufficiency and saturation (Seidman, 2013). According to Seidman (2013), sufficiency referred to having enough participants in a sample to represent the "range of participants and sites that made up the population so others outside the population could connect to the experiences of the studied population" (p. 58). Saturation was the point where the researcher was not learning any new information from the research participants (Lincoln & Guba, 1985 as cited in Merriam & Tisdell, 2016). Participants who were rural elementary and middle grade science teachers in one state in the southeastern United States were invited to participate in this study. I recruited participants for this study by electronically sending letters of cooperation to the superintendents of all the rural school districts in one state in the southeastern United States.

I then emailed letters of cooperation to the principals in all the school districts where the superintendent gave permission for me to conduct my study. I attached the consent form for interviews to this email and requested principals forward the email to all of their Grades 3, 4, 5, 6, 7, and 8 science teachers. I selected the first 10 participants that consented to be interviewed or until data saturation was reached for this sample. The selection of 10 participants or until data saturation was reached allowed for the discovery of in-depth, information-rich data (Merriam & Tisdell, 2016).

The actual number of participants were controlled by the actual number of participants who volunteered to be interviewed. I exhausted all resources and options available to obtain potential participants. In the event of an overage of 20 participants to volunteer for this study, I began the interviewing process with the first 20 participants to volunteer. I did not email any potential participant to inform them I was unable to gather their experiences in my study at this particular time due to having already approached my study's participant quota until after a two week grace period had exceeded the emailing of the last reflective journal entries. I did, however, request permission from the overage of potential volunteers to contact them at a later date should any of the participants decide to withdraw from the study or need to be excluded due to not meeting the study's criteria.

Another aspect of importance to this study was location. To adequately represent the intentions of rural elementary and middle-grade teachers in one southeastern state in the United States, I recruited teachers meeting these criteria from all rural elementary, middle, and K-8 schools in the area. Since I covered such a large geographical area, I preferred to interview participants by telephone and to administer the reflective journal by email. Although in-person interviews were the desired method for qualitative research, it was not within reason to travel to locations outside of a 100 mile radius to interview each participant. In the event, a participant lived in close proximity and was available to be interviewed in person, I made the necessary accommodations.

Procedure for Recruiting Participants

The following set of procedures were used to inform and recruit participants:

1. Obtained Walden University's Internal Review Board approval to conduct this study.

2. Contacted the superintendents of each rural school district in one state in the southeastern United States by email to share study intentions and to get electronic signatures on letters of cooperation.
3. Contacted the principals of each of the rural elementary and middle schools in the school districts where the superintendents had electronically signed letters of cooperation to share study intentions to recruit teacher participants. The letter of invitation contained information about the study and gave directions on contacting me if there was an interest in participating in this study. Began the interviewing process on a first come, first serve basis in the event of an overage of 20 participants volunteered to participate in this study.
4. Sent a follow-up email within two weeks if not enough participants volunteered. I also asked the principals to remind teachers about my study if possible. As there was still not enough volunteers for my study, it was also necessary to recruit teachers through social media sites such as Linked In or Facebook.
5. Set up interview times with the participants who contacted me. Interviews were via telephone. I confirmed the eligibility of each participant to participate in this study before the interview. There was an interview 45-60 minutes in length with each participant.
6. Prior to beginning each interview, I explained the purpose of the study, procedures to ensure confidentiality, and had each participant electronically sign a letter of consent. I informed participants that notes were taken during

the interview, but also audiotaped the interview with each participant's permission.

7. I provided my contact information to each participant at the conclusion of the interviews to reach me should any questions about the study arise. I also emailed the reflective journal to each participant and asked they complete it within three business days as part of the debriefing process. I also requested each participant's permission to contact them by email or telephone for any follow-up questions.
8. I emailed any potential participant excluded from the study due to participation number exceeding the study's maximum number of 20 participants. I informed such participants I was unable to gather their experiences in my study at this particular time due to having already approached my study's participant quota. I did, however, request permission from the overage of potential volunteers to contact them at a later date if any of the participants decided to withdraw from the study, needed to be excluded due to not meeting the study's criteria, or failed to complete the reflective journal entries within the maximum 2 week grace period after the reflective journal entries were emailed.
9. I contacted research participants after the study to ask follow-up questions or to clarify interview responses. I made such contact by email and telephone.
10. I shared study's results with participants and asked them to provide feedback or clarifications they liked for member checking.

Instrumentation

I was the primary source of data collection. I used a semi-structured interview (Appendix A), and a reflective journal (Appendix B) as my data collection instruments. Both of these instruments were designed to provide data about the research questions for this study. I created an alignment chart for these instruments in relation to the research questions. The alignment chart was placed in Appendix C. The research, interview, and reflective journal questions are centered on the theoretical framework of Ajzen's (1988) theory of planned behavior and a gap in the literature. The research, interview, and reflective journal questions were also centered on the transcendental phenomenological method. I conducted a single 45- 60- minute telephone interview with each participant from my home office, following a general interview guide that asked questions of varying types to elicit responses necessary to answer the research questions (Merriam, 2016; Moustakas, 1994). Because it was my assumption that the participants would view integrating STEM career-related lessons in different ways, the interview questions were open-ended for this semi-structured interview. During the interview, I audiotaped the responses of the participants to capture the essence of their lived experience with the studied phenomenon. The interview questions are as listed in the next section.

Interview Questions

The specific questions I used to guide my interviews with the 10 teacher research participants included:

1. How do you describe your intention to integrate STEM career-related lessons into the science courses you teach?

2. What role do your intentions play into the frequency in which you integrate STEM career-related lessons during science instruction?
3. Do you believe teachers, in general, should integrate information about STEM careers into science courses? Why or why not?
4. Do you believe it to be a part of a teacher's responsibility to encourage students to become more interested in STEM careers? Why or why not?
5. How do you believe the emphasis on state standards and state assessments impacts your preparation of students for careers in science?
6. What influence would you describe your administration as having on your integration of STEM career-related lessons into the science courses you teach?
7. Does the textbook and instructional materials you use include any information about science careers? If so, how?
8. How do you describe your capability to integrate information about STEM careers into the science courses you teach?

These eight interview questions were aligned with the research and sub-research questions to explore how intentions impact rural elementary and middle-grade teachers' actual integration of STEM career-related lessons into science instruction.

Reflective Journal

According to Seidman (2013), the last phase of interviews, in general, was that of reflection. To satisfy this element, I established a three question open-ended response essay created using Microsoft Word that I emailed to participants as part of their debriefing from the interview (Appendix B). The emailed reflective journal essay was emailed to participants after I concluded participants' interviews. Participants were asked to email the reflective journal entries back to me using the email address I provided them within three business days. The purpose of the reflective journal was for teacher participants to reflect on their experiences and their instructional practices relative to their intentions to integrate STEM career-related lessons during science instruction. The rationale for the reflective journal to be administered as part of the debriefing process from the interview was for the research participants to clarify any areas of ambiguity and to offer the researcher additional information about the research participants' intentions. The research participants' responses to the reflective journal entries also assisted me with identifying participants I needed to conduct follow-up interviews with and create additional open-ended questions I needed to ask selected participants during the follow-up interviews for clarification. The specific questions I asked in the reflective journal are as follows:

Reflective Journal Question 1: What successes and challenges have you had with fulfilling your intentions to integrate STEM career-related into the science courses you teach?

Reflective Journal Question 2: What are your beliefs about encouraging students in the grade level you teach to explore science careers?

Reflective Journal Question 3: What specific factors and/or needed resources do you see as enabling or preventing your intention to integrate STEM career-related lessons during science instruction?

An alignment chart correlating these instruments to the research questions is shown in Appendix B.

Data Analysis

Documents used for data analysis included interview transcripts and participants' responses to the reflective journal. A modification of the Van Kaam method of analysis for phenomenological data, as recommended by Moustakas (1994), was used for this study. The data analyzed was transcribed interview transcripts. These seven steps were involved in the Van Kaam method of phenomenological analysis. These seven steps are discussed next.

Step 1 involved listing and grouping every expression relevant to each individual participant's experiences and instructional practices relative to rural elementary and middle grade teachers' integrating STEM career-related lessons during science instruction. This process of horizontalization was conducted using open and hierarchical axial coding. Open coding was used after the interview transcripts were transcribed. After transcription, I manually scanned the interview transcripts and submitted journal entries in search of repeated words and phrases. Using open coding was justified because such a coding method presented the opportunity to look for the main words and phrases within the interview transcripts that were constructed into categories.

After these common words and phrases were identified, hierarchical axial coding was employed when these categories were placed into groups. Hierarchical axial coding was used to sort the open codes into groups and categories to identify common themes. After these common themes were established, these themes were named as tentative categories relative to participants' experiences and instructional practices. Step 2 of the modified van Kaam method of phenomenological data analysis involved reducing and eliminating expressions that showed no relation to participants' experiences and instructional practices. Step 2 was conducted in relation to integrating STEM career-related lessons during science instruction in the elementary and middle-grades.

The conducting of Step 2 involved reducing and eliminating any expressions that overlapped, were repetitive, or were vague. The expressions that remained were the reported invariant constituents or final categories of experiences and instructional practices with the studied phenomenon. Step 3 involved clustering and labeling the invariant constituents or categories. These labels were then translated into the main themes of experience and instructional practices relative to integrating STEM career-related lessons during science instruction. Step 4 involved validation of the themes.

Step 4 was accomplished by checking the themes against the complete interview transcripts of each participant for explicit expression or compatibility. Themes not explicitly expressed or compatible were deleted. Step 5 involved constructing an individual textural description of experience and instructional practices in relation to integrating STEM career-related lessons during science instruction in the elementary and middle grades. This individual textural description was constructed for each participant using verbatim excerpts from the interview transcripts. Step 6 involved constructing an individual structural description of experiences and instructional practices about integrating STEM career-related lessons during science instruction in the elementary and middle grades.

These structural descriptions provided a clear account of the underlying dynamics of the experiences and instructional practices, and they were constructed using imagination, reflection, and analysis. Step 7 involved composing a textural-structural description of the meanings and essence of experiences and instructional practices relative to integrating STEM career-related lessons during science instruction in the elementary and middle grades. Embedded were the invariant constituents or categories and themes into this textural-structural description. From these individual textural-structural descriptions, developed was a composite description of the meanings and essence of experiences and instructional practices relative to integrating STEM career-related lessons during science instruction in the elementary and middle-grades. This composite description represented the intentions of the participants for this study.

Discrepant Data

The intention was to examine the interview data for patterns that emerged. However, not all data allowed for the emergence of such patterns. Data obtained that did not seem to fit into the emerging theme was not discarded. I, instead, labeled this information as discrepant data. The discrepant data was reported in the results section of Chapter 4 because discrepant data challenged one or more of the key findings.

Issues of Trustworthiness

Researchers must have safety measures in place to address any challenges to the study findings that may arise, to ensure the trustworthiness of qualitative research. These security measures ensured reduced potential researcher bias, and that the study findings were objective, credible, and dependable. The researcher also had safeguards in place to guarantee research was presented and interpreted in such a manner that the rich, thick descriptions of the study were contextualized (Merriam, 2016). This was so future researchers could have a clear picture of the extent to which the research could be transferred or applied to their situation (Merriam, 2016). I will now discuss the constructs of credibility, dependability, transferability, and conformability, all components of the trustworthiness in this study.

Credibility

Credibility was the congruency of research findings with reality (Merriam, 2016). Member checks and adequate engagement in the data collection process were used to ensure the credibility of this proposed study. The first strategy used to ensure credibility were member checks. According to Maxwell (2014), member checking involved asking participants if they believed the tentative research findings were plausible. Therefore, each participant was extended an opportunity to review the findings of transcribed interviews to assess the credibility of the findings.

The second strategy used to enhance the credibility of this study was to ensure adequate engagement in data collection. Merriam (2016) explained that adequate engagement in data collection was related to how long a researcher must observe a phenomenon. According to Merriam (2016), adequate engagement could also be in how many participants need be interviewed until the data and emerging findings felt saturated. Saturated meant that the data and emerging findings yielded duplicate results. Merriam (2016) also noted the time spent collecting data should be linked to the researcher's understanding of the phenomenon by searching for alternative descriptions or explanations of the phenomenon. The strategy of adequate engagement in data collection was used by purposefully seeking responses during the interview phase of data collection that challenged the patterns that emerged. I analyzed data for discrepancies and report such data in Chapter 4.

Dependability

Merriam (2016) defined dependability in qualitative research as yielding study findings consistent with the presented data. The strategy of an audit trail was used to ensure the dependability of this research. This audit trail, according to Merriam, enabled researchers to understand how results were attained so they can replicate the study. For this study, the audit trail was a research journal that described my data collection and analysis processes. It also contained a running record of how my study's data was interpreted and analyzed. The audit trail journal was kept in a secure, fireproof box with the transcripts and audiotapes of the interview sessions. Data was stored for a period not to exceed five years before it was shredded.

Transferability

Merriam (2016) defined transferability as the ability of the research findings to be applied to other settings. To enhance the probability of transferability of this research to other settings, the strategy of rich, thick description was used. This rich, thick description was given through use of Merriam's (2016) suggestion. Rich, thick descriptions included a detailed description of the study's setting and participants (Merriam, 2016). Also, I presented detailed descriptions of the study's findings with quotes to ensure adequate evidence was presented (Merriam, 2016). Such quotes were obtained from the interviews and the reflective journals.

Confirmability

Merriam (2016) recommended qualitative researchers consider the use of the strategy of reflexivity to enhance the confirmability of research. To understand reflexivity, we must first understand its definition. Merriam (2016) defined reflexivity as the researcher's position about assumptions and biases that may affect the results of the study. The strategy of reflexivity were used by reflecting on biases, dispositions, and assumptions about the research being conducted, as recommended by Merriam. A description of the disclosure process follows.

This disclosure, according to Merriam, helped readers to gain a sense of the integrity of the researcher and to get an understanding of how the researcher interpreted the data collected. Therefore, an audit trail to provide readers with a detailed accounting of the research process was used. As recommended by Merriam, this audit trail contained thoughts, questions, ideas, and any issues that arose during the data collection phase. It also contained a running record of how data collected was analyzed and collected to give readers a better understanding of how the categories and themes were created in relation to the findings of this study. The next section included a focus on ethical procedures.

Ethical Procedures

Ethics were a critical part of the use of human subjects in qualitative research according to Merriam (2016). I followed several protocols to ensure the ethical treatment of all participants. First, to ensure compliance with the guidelines set forth by Walden

University and federal regulations intended to protect human rights, an application was submitted to Walden University's IRB, seeking permission to conduct this research. This IRB application ensured that all aspects of this proposed research were in line with Walden University's ethical standards. This application addressed the ethical considerations and protective measures extended to all research participants. I needed to acquire Walden University’s IRB approval prior to beginning this study.

Once I received IRB approval, I obtained electronically signed letters of cooperation from the district administrators and principals at the research sites. I also obtained electronically signed letters of informed consent from all participants in this study. The letter of informed consent explained the purpose of the study, the voluntary nature of the study, and my contact information. Next, I explained the study's risks and benefits to participants. Also, I explained measures for ensuring collected data was kept confidential. I explained all collected data was kept on a password protected computer. In addition, the audiotape used to record interviews, handwritten notes, and hand coded data was kept in a locked, fire-proof box. Once, the study was completed, I kept the data for a period not to exceed 5 years before it was shredded in a cross-cut shredded and personally disposed of a county-operated trash collection site. Finally, I explained to all participants their identities will remain confidential through pseudonyms for the school districts, the schools, and the participants. This measure of confidentiality applied to both data collection and data analysis. Participants were informed of their right to withdraw before, during, or after the study via e-mail.

Summary

This chapter described the proposed research methodology for this study. The purpose of this transcendental phenomenological study was to describe intentions of elementary and middle-grades science educators towards integrating STEM career-related lessons during science instruction in the elementary and middle grades. I collected data from interviews and reflective journals with 10 participants. These participants were rural elementary and middle-grade science teachers purposefully selected according to specific inclusion criteria. I used the seven steps of the modified Van Kaam method for data analysis (Moustakas, 1994). I used several strategies to ensure the credibility, dependability, transferability, and conformability of the study to further enhance the trustworthiness of this study. Multiple strategies also ensured the ethical treatment of the research participants.

Chapter 4: Results

Introduction

The purpose of this transcendental phenomenological qualitative study was to understand how intentions impact rural elementary and middle-grade teachers' integration of STEM career-related lessons into science instruction. The research questions investigated in this study were:

RQ1: What are intentions of rural elementary and middle-grade science teachers as it pertains to integrating STEM career-related lessons during science instruction?

SQ1: What do rural elementary and middle-grade science teachers believe about integrating STEM career-related lessons during instruction in the elementary and middle-grades?

SQ2: How do rural elementary and middle-grade science teachers describe influence from subjective norms in integrating STEM career-related lessons during science instruction to elementary and middle-grade students?

SQ3: What resources do rural elementary and middle-grade science teachers describe as impacting their participation in integrating STEM career-related lessons during science instruction to elementary and middle-grade students?

SQ4: How do rural elementary and middle-grade science teachers perceive their capability in integrating STEM career-related lessons during science instruction to elementary and middle-grade students?

In Chapter 4, I provide an overview of the key results of this study of rural elementary and middle-grade science teachers' intentions to integrate STEM career-related lessons during science instruction. In Chapter 4, I also describe the research setting, participant demographics, data collection and analysis procedures, evidence of trustworthiness, and results. In Chapter 5, I interpret the results presented in Chapter 4 and discuss the limitations of the study. I also offer recommendations and implications.

Setting

This study was conducted in six rural school districts in one state in the southeastern United States, and participants were limited to science teachers assigned to Grades 3, 4, 5, 6, 7, and 8. These six rural school districts comprise one consolidated school district. Information gathered from the consolidated school district's report cards showed 30,330 PK-12 students were enrolled during the 2016-2017 school year. Included in these 30,330 PK-12 students were 13,260 students in Grades 3-8. The district employs 2,038 teachers in its 67 schools.

Demographics

Sixteen rural science teachers indicated an interest in participating in this study. However, one teacher resigned her position prior to the interview. Three teachers did not teach science full-time and two teachers did not submit their consent forms. Ten full-time science teachers electronically signed and submitted their consent forms to participate in the interviews. Teacher participants' names were common English names, but I assigned them pseudonyms to protect their identity. The length of time the participants had been teaching ranged from 3.5 years to 30 years. Two of the participants were male and eight of the participants were female. Six participants were African-American and four were Caucasian. One teacher taught Grade 3, two teachers taught Grade 4, two teachers taught

Grade 5, two teachers taught Grade 6, and three teachers taught multiple grade levels. In addition, six teacher participants taught in an elementary school setting; while, four teacher participants taught in a middle-grade setting.

The 10 teacher participants who signed the consent form had been full-time science teachers for an average of 13.85 years in one southeastern state. All of the teacher participants were secured through purposeful sampling. Four of the teacher participants volunteered for participation in the study after expressing an interest in the letter of invitation I sent via their district email addresses. The remaining six participants volunteered after being recruited on Facebook through closed science education groups. All of the participants participated in all aspects of the study, including returning their reflective journal entries within the given time frame. During the course of the interview, all of the participants shared their commitment to lifelong learning even though their educational level was not reviewed.

Albert (pseudonym) is a Caucasian male and teaches Grade 7 and Grade 8. He has taught in his same role for the past 15 years. Ashley (pseudonym) is a Caucasian female. She has taught Grades 4 and 5 science classes during her 7 year teaching career. Sarah (pseudonym) is an African-American female and has taught Grade 6 science for the past 15 years. Sarah has taught science to Grades 6, 7, and 8 over the course of her 30 year teaching career.

Ann (pseudonym) is an African-American female. She has taught Grades 7 and 8 science courses for the past 15 years. Billy (pseudonym) is an African-American male and teaches Grade 4 mathematics and science. Billy has taught in his current capacity for the past 3.5 years. Originally, Billy majored in computer science during his undergraduate collegiate career.

Betty (pseudonym) is an African-American female and teaches a self-contained Grade 3 class. Betty has taught for 27 years. She began her career by teaching Grades 4, 5, and 6 mathematics and science. She is a former science coach and a Science and Technology Concepts (STC) and Full Option Science System (FOSS) science kit trainer. Audrey (pseudonym) is an African-American female Grade 6 science teacher. She has been a teacher for the past 25 years.

Felicia (pseudonym) is a Caucasian female Grade 6 science teacher. She has been a teacher for the past six years. She began her teaching career in her district's middle school, but was moved when the district built a new elementary school. Karen (pseudonym) is a Caucasian female teacher. She is responsible for teaching 78 Grade 5 students in her district's magnet school. However, she also stated she integrates Grade 4 students into her self-contained science classes, since she is the more experienced teacher when dealing with the students' behavioral challenges. She has been teaching science for the past 4 years.

Blanche (pseudonym) is an African-American female teacher. She teaches Grade 4 science and has been a teacher for the past 12 years. Although, she is certified in early childhood education (grades PK-2), she has been teaching in her current role for the past 6 years. A summary of the teacher participants' demographics is presented in Table 2.

Table 2

Teacher Participants Demographics

Name of participant	Race	Gender	Grade(s) taught	Years teaching science	Educational setting
Albert	Caucasian	Male	7, 8	15	Middle
Ashley	Caucasian	Female	5	7	Elementary
Sarah	African-American	Female	6	30	Middle
Ann	African-American	Female	7, 8	15	Middle
Billy	African-American	Male	4	3.5	Elementary
Betty	African-American	Female	3	27	Elementary
Audrey	African-American	Female	6	25	Middle
Felicia	Caucasian	Female	6	6	Elementary
Karen	Caucasian	Female	4,5	4	Elementary
Blanche	African-American	Female	4	6	Elementary

Data Collection

Data collection began on March 26, 2018 when I received notification of approval (03-26-18-0182750) from the Walden University Institutional Review Board conditional upon receiving approval from research partners. I emailed superintendents in 76 of the 85 school districts in one state in the southeastern United States in search of letters of cooperation. The rationale for sending requests to such a large number of school districts was that there was no clear indication of which school districts were rural due to school district consolidation and number of school districts within a county. I received a letter of cooperation from my first research partner on March 30, 2018. The Walden University Institutional Review Board granted full approval to conduct research on April 6, 2018.

I received a total of six school district approvals to conduct research. However, only four school districts submitted the correct documentation (i.e., approvals signed by the school district's superintendent on school letterhead) for the Walden University Institutional Review Board to grant approval. I then emailed the principals of the elementary and middle grade schools within the school districts where I had signed and approved letters of cooperation from both the superintendent and the Walden University Institutional Review Board. The purpose of emailing the principals was to request they forward a letter of invitation to potential teacher participants. Four teacher participants volunteered for this study as result of a principal forwarding the letter of invitation. Thus, it became necessary to recruit participants using social media sites after a 2-week timeframe had elapsed.

I placed a recruitment ad on LinkedIn and received approval from several Facebook science group site administrators to post my letter of invitation. This method yielded an additional six teacher participants. The volunteering participants provided me with a best time and date to call for the interview based on their schedules. I was able to accommodate the interview scheduling needs of the volunteering participants.

As the researcher, I ensured my home office was quiet and inaccessible to any unwanted intruders as I was conducting the interviews. To capture individual's conscious experiences, I used Microsoft Office OneNote and an Olympus VN-541PC hand-held digital voice recorder to record private telephone interviews for transcription. During the interviews, I read each interview question from a pre-printed interview guide (Appendix A) to ensure each interview question was asked clearly and precisely. I also made notes of similar information to be able to determine when data saturation was reached. I also repeated any question the participant requested. I practiced active listening as each participant shared their experience.

After the participant had finished providing their response to my interview questions, I asked follow-up questions for clarity. I informed participants I would email them a 3-question reflective journal entry to be returned within 3 business days to debrief from the study. All of the participants participated in all aspects of the study, and all returned their reflective journal entries within the given time frame. Interviews for this research study occurred between April 22, 2018 and June 2, 2018.

None of the interviews exceeded 45 minutes in duration. Each interview was saved in Microsoft Office OneNote on a password-protected computer. In addition, I stored the Olympus VN-541PC hand-held digital voice recorder in a fireproof lockbox separate from the participants' signed consent forms with the teacher participants' government names and interview notes. None of the teacher participants reported any adverse events that may have impacted their responses. Nor did any of the participants express an interest in withdrawing from the study, have any information redacted, and report any psychological, emotional, or medical issues as a result of this study.

Data Analysis

A modification of the Van Kaam method of analysis for phenomenological data, as recommended by Moustakas (1994), was used for this study. The modified van Kaam phenomenological data analysis method involved seven steps. Step 1 involved listing and grouping every expression relevant to each individual participant's experiences and instructional practices relative to rural elementary and middle grade teachers' integrating STEM career-related lessons during science instruction. Step 2 involved reducing and eliminating expressions that show no relation to participants' experiences and instructional practices. Step 3 involved clustering and labeling the invariant constituents or categories. Step 4 involved validation of the themes.

Step 5 involved constructing an individual textural description of experience and instructional practices in relation to integrating STEM career-related lessons during science instruction in the elementary and middle grades. Step 6 involved constructing an individual structural description of experiences and instructional practices about integrating STEM career-related lessons during science instruction in the elementary and middle grades. Step 7 involved composing a textural-structural description of the meanings and essence of experiences and instructional practices relative to integrating STEM career-related lessons during science instruction in the elementary and middle grades. In the proceeding section, I present a description of how the interview transcripts were analyzed in regards to these seven steps.

Step 1: Listing and Grouping

I began to transcribe each interview as soon as the interview concluded. I listened to each interview multiple times to ensure accuracy. I also emailed a copy of each interview transcript to each teacher participant and requested they review the transcript for accuracy. None of the teacher participants requested any corrections to their interview transcripts. I then compiled each of the teacher participants responses into one Microsoft Word document and printed a hard copy to make manual coding easier. As Miles, Huberman, and Saldana (2014) stated: “The ultimate power of field research lies in the researcher’s emerging map of what is happening and why” (p, 93). So as I read the interview transcript, I used different colored highlighters to note keywords, phrases, and sentences related to the teacher participant experience with the asked interview question.

I, then, used open coding to search for repeated words and phrases. The repeated words and phrases I found can be seen below in Figure 2.

Figure 2. Listing and grouping.

I, then, used horizontal axial coding to group these words and phrases. I grouped these words and phrases into a list. In this step, I searched the interview transcript for essential information pertaining to rural elementary and middle-grades' science teachers' intentions to integrate STEM career-related lessons during science instruction. I then isolated and assigned equal value to statements meeting this criteria.

Step 2: Reducing and Eliminating

In the second step, I reduced and eliminated statements within the coded data to construct major categories that emerged from the teacher participants' responses to the interview questions. In step 2, I used two questions to determine whether a statement could possibly become a category. The two questions I asked myself during this process included: (1) Will this statement provide valuable insight about teachers' conscious experiences with integrating STEM career-related lessons during their science instruction? And (2) Can this information become a useable category? Once I read an expression, if the answer was yes to both of these questions, a category was created.

Interview Question 1 (IQ1) asked: "How do you describe your intention to integrate STEM career-related lessons into the science courses you teach?"

A main category created in response to this interview question was teachers intended to integrate STEM career-related lessons into taught science courses. A second category created in response to this interview question was STEM activities. Four of the 10 teachers described use of a STEM activity during their science courses and using the STEM activity to make real-world connections, introduce available STEM careers, and to bring clarity to the science topic under study. Billy stated: "First, in my class we do a lot of robotics dealing with engineering. I know that a lot of times the engineering aspect is often forgotten when dealing with STEM at the elementary level." Betty believed STEM activities offer real-world connections. Betty noted, "It's giving them a clear understanding of how what we're talking about relates to the world around them."

A third category that emerged in response to this interview question was discussions. In response to Interview Question 1, teacher participants indicated their intention to integrate STEM career-related lessons during science instruction was evident through STEM-related discussions. Ashley added: "After completing a STEM activity, we discuss how it is relevant in real life concerning skills, jobs, and careers." Billy expanded on this rationale stating: “In my class, I tell them they are building engineers. Some of them are traveling engineers. And some of them are actually computer engineers.” Felicia stated discussions are “just to try to give them an overview, because we live in a small town so they don’t get to get out and see all the other jobs that are out there.” Furthermore, Felicia indicated discussions allow opportunities to bring in prior knowledge. Felicia said during discussions, “They connect really quickly and say, ‘I know so and so’”.

Another category that manifested through teacher participants’ responses to the interview questions was the bringing in of external sources. Several of the teacher participants indicated using partnerships to support their intention to integrate STEM career-related lessons during science instruction. In regards to partnership use, Sarah stated:

> Well, I prepare myself every year. I was blessed enough to receive about four fellowships in the past and with my fellowships, I generally train with scientists every year through partnerships over the summer in a lab. And what has been happening is that those partners help me design curriculum and then, I integrate it into the class. Now, some of it is a little expensive and so, I am crawling before I walk.”

Karen, too, shared funding impacted her integration of STEM career-related lessons during science instruction. Karen confessed her intention to integrate STEM career-related lessons during science instruction was connected to the availability of funding. Karen added: “This year this was more successful, because I was there along with 4-H to do things like the ducks and other things like that.”

In summary, four categories emerged during the data analysis of teachers’ descriptions of their intentions to integrate STEM career-related lessons during science instruction. Teachers believed in the integration of STEM career-related lessons during science instruction. Teachers believed STEM activities assisted in their integration of STEM career-related lessons during science instruction. Teachers routinely engaged students in STEM career discussions. Teachers believed in the bringing in of external sources to support their intention to integrate STEM career-related lessons during science instruction.

Interview Question 2 (IQ2) asked: “What role do your intentions play into the frequency in which you integrate STEM career-related lessons during science instruction?”

The first category constructed in regards to this interview question was teachers agreed the integration of STEM career-related lessons during science instruction should be student-centered. The second category constructed in regards to this interview question was the regular integration of STEM career-related lessons. Ann and Sarah described their intention to integrate STEM career-related lessons during science instruction on a daily basis. Ann stated: “I intend to incorporate STEM in my classes on a daily basis.” Sarah indicated that this daily intention could be viewed as a mere “mention [of] it or [as] some type of discussion”. However, Karen, Ashley, and Betty indicated a weekly integration of STEM career-related lessons during science instruction. Moreover, Ashley stated: “STEM is a huge trend in science instruction right now.” Betty seemed to expand on Ashley’s thoughts with her response that showing students different careers in science helps students to link scientific discoveries to students’ everyday life. Betty believed the mention of STEM careers such as: “biologists … zoologist …. different types of scientists…mathematicians … electricians” proved useful in helping students to see “how things have changed.” Felicia noted the integration of STEM career-related lessons should come naturally. She said,

> Do I plan for this frequency? I probably don’t plan for that at this time. It kind of just comes up naturally each time I introduce a unit, or if it’s something new and I know there is a specific job involved. They [the students] might already know there’s a job about it. If not, we open up and tell more about it.

A third major category that emerged during data analysis of the teacher participants’ responses to this interview question was facilitation of learning. Teachers described their roles as being more facilitator than teacher. Albert emphasized,

> My role is facilitator and the pivotal point that opens the student up to new careers. Because in the low income areas I teach, they are not acquainted, or knowledgeable of the different careers they can get into or that comes from STEM. They know maybe retail or whatever is going on in their community. So, I am there like the bridge that opens them up to what’s on the other side.

In Sarah’s role as facilitator, she found “they’re [students] not used to it. So, sometimes we have to design it in a blueprint formation and then teach it in really small steps.” Betty articulated,

> My role is more of someone who monitors the investigations the students are doing. Trying to lead them to think about more of what's going on. So, they can ask more questions. So, they want to investigate more. I don't want to think of myself as a teacher when we get into it. Or, someone who's just guiding them through the activities and the investigations that they're doing. I want them to be the investigator. I want them to lead the discussions. So, I try to foster that type of environment. It doesn't happen as often as I would like it to happen throughout the year. But, I definitely try to make sure at least once a week maybe twice that we're conducting some type of STEM or hands-on activity.

Karen preferred the facilitator role to "see where their [students'] minds go with whatever they're doing." Much to the same sentiment Blanche noted,

> For my class, it's more student-centered. I don't give any answers. Everything is researched or they have to experiment to find the answer or you know, do a hands-on activity. I don't give any answers at all while we're doing the lesson. Either after the experiment, after they find their findings, we'll discuss it and have constructive arguments in the class trying to figure out, "Well, if you think it's true, prove it!" So, they know I'm not going to give answers at all. And after we decide and find the true meaning of whatever it is we're investigating, then that's how they find the answer. So, it sticks to them more when they find it on their own versus me telling them. It's like, "I'll remember for that moment", but if they find it on their own, they'll always remember that moment."

In summary, three categories emerged during the analysis of Interview Question 2. These three categories included the integration of STEM career-related lessons should be student-centered, should be in regular intervals, and teachers should assume the role of facilitator.

Interview Question 3 (IQ3) asked: “What are your beliefs about the integration of information about STEM careers into science courses?”

The first major category that emerged was teachers overwhelmingly believed it to be of the utmost importance to integrate information about STEM careers into science courses. Teachers credited this perception of importance to aspiring students to develop a passion for STEM, connecting students to future aspirations, supplying the future STEM workforce, and for global competitiveness. A second major category from this interview question was the creation of a love for science. Ann stated: “I believe that when children are taught the basics of STEM and I show the students my love of the field through hands-on activities, the students will develop a love for science too.” Billy believed developing this love of science could transfer “in [to] real-world situations so that my students can make something that is tangible to them.” Ashley noted students who were passionate about STEM should be “informed of future possibilities concerning their jobs and careers.” Blanche offered much the same suggestion and added, “But it should be embedded. Because that’s what this world is turning towards. It’s more science, STEM-type activities that’s trying to get the kids really thinking about improving what’s already been done.

A third major category that emerged was the presentation of STEM careers as an attainable goal. Albert believed students needed to see how activities are translated in future STEM careers. Albert stated, “So it is important that kids know that like the little things they do like robotics and like making little stuff opens them up to like STEM careers.” Audrey believed STEM “is really what they are going to be facing now” and according to Albert, “is an area for pretty much other careers.” Sarah held belief that the key to filling future STEM job vacancies was to provide baseline knowledge to fuel this passion. Sarah said,

> Well, what I believe is that every child has to have at least a baseline knowledge of engineering in their science curriculum, because the world number one, is like really in need of engineers. Our infrastructure is depreciating. Engineers or designers and leaders of the old school are getting older. And particularly with technology, students have to get that STEM knowledge. …And I know that Boeing and some other entities are around. And the kids need to know this, because we have a really, really tight situation. We have a high demand for aeronautics engineers particularly with the travel to Mars coming up. Also, with pilots. … inviting children to be pilots of aviation. … [Also,] I know a couple of airplane mechanics that make a very nice living. And a lot of children, believe it or not, want to be mechanics. Instead of them all running to cars or automobiles, we were thinking, well why you don’t consider airplane mechanics?

Felicia believed teachers exposing students to STEM careers could have lasting effects on molding students’ future aspirations. Felicia stated,

> I think it's important that kids know this, because they've got to realize that these STEM jobs and the things we are teaching are possible jobs for them. If you don't open up to them and let them know, they don't have that idea. They can't connect and see the future of being in one of these jobs. You know what I mean. So, it's important that they get to hear those things and see those job opportunities.

In summary, three categories emerged during the analysis of Interview Question 3. These three categories included teachers' deeming the integration of information about STEM careers to be important, creating a love of science within students, and the presentation of STEM careers to students as an attainable goal.

Interview Question 4 asked, "What do you believe about the teacher's responsibility to encourage students to become more interested in STEM careers?"

A major category that emerged was teachers believe it to be their responsibility to encourage students to become more interested in STEM careers. Teachers believed this encouragement should be in the form of fun, engaging, encouraging, and informative hands-on activities. Another major category that emerged from teacher participants' responses to Interview Question 4 was making science appealing to students. Albert believed making STEM more appealing would assist with alleviating negative stereotypes about STEM. According to Albert, "STEM can be portrayed as a little bit abstract or it probably comes off as being difficult or that the students have to be smart to be involved in. When, it's like basic little stuff as I said like robotics." Alleviating STEM stereotypes would prepare students for global competitiveness. Betty stated, "So just getting students to think out of the box and to think I mean that would put us up with other countries who are really working towards embracing STEM and science and math across the curriculum." Sarah indicated,

> If you're going to number one be a teacher just like those doctors have an oath they have to take, teachers have an obligation to examine what they perceive as future plans, future pathways and to may sure the students are thinking about and gradually preparing for it particularly in [one consolidated school district in one state in the southeastern United States because our mission and vision statements both align as far as being really a global system. Everyone has to be ready for being able to work with people all over the world and STEM is just everywhere. I don't care if you are not a scientist, you're still going to have to deal with science, technology, engineering, and mathematics in some kind of way. So, I don't think you're are really a teacher unless you're integrating it in some kind of way in all subjects.

In integrating STEM career-related lessons during instructional times, Ashley stated teachers could provide "opportunities to research and explore STEM options." It would also help as Ann puts it "keep the students focused." In doing so, Billy believed integrating STEM career-related lessons during science instructional periods would "encourage students in those type careers that match their ability." Blanche confessed that while she does encourage students in STEM she tends to specifically target a specific gender group-females. Blanche justified,

> Well, my focus for the past two or three years is to get more girls involved with STEM. That's science, technology, engineering, and math. Once they leave from

> the primary and elementary grades, once they get older they break away from the science, technology, and engineering. They aren't interested. They don't major in these fields when they go to college. So, I'm trying to get them more involved in science. They love it when they are in the fourth grade or so. But when they get older they tend to major in different things. And they're a lot of fields out there that are there for young girls, but they just need to major in them. And they pay a lot of money. But when girls think about science and technology-type stuff, they think about the basic computer and nursing. You know. So, there are so many other jobs, opportunities, and fields out there for girls, just waiting on them, and I'm just trying to get them to see what it is they like now. Like seeing how they interact with the lessons that we're doing so that if a student is so much more, yes, she loves science, but she's really interested in the animals or zoology type stuff. Or, their might be a student that loves science, but her area that I see she's really interested in is weather and weather instruments so she might be a meteorologist. Different things like that. But the boys normally like science. The only thing is they like hands-on. They like building stuff and breaking things down. But, the girls I have been focusing more on them the past few years trying to get them more involved.

In summary, a major category that emerged was teachers believed it to be their responsibility to encourage students to become more interested in STEM careers. A second major category that emerged from teacher participants' responses to Interview Question 4 was making science appealing to students.

Interview Question 5 asked, "How do you believe the emphasis on state standards and state assessments impacts your preparation of students for careers in science?"

A major category that emerged was six of the 10 teacher participants believed standards and state assessments were actually aligned with preparing students for careers in careers in science. However, these same teachers believed standards must be interpreted, applied, and taught properly for this to occur. A second major category that emerged was the need to connect standards to tangible STEM careers. Sarah expressed,

> Well, I believe that the standards are pretty much excellent, but where we fall short is we're not really taking those standards and putting them in motion. There's not enough support for hands-on. There's not enough resources …I think every standard should have something connected to it as far as a hands-on so that the teacher is not running like a headless chicken out the gate. And I think the teacher should be trusted more. I think the standards are aligned. I just feel like the kids don't get the standards. They don't get it and particularly with the young ones, a lot of them are concrete learners and if they don't see, it doesn't exist to them yet.

Billy comments were similar to the ones of Sarah. Billy expressed,

> When it comes to standards, it's a very funny situation. Of course, you need to teach the standards based off whatever the standards are and whatever the curriculum is for that grade level. But, it's not just teaching the standards, you need to incorporate the standards. Pretty much making things hands-on, making sure things are tangible, and not just oh giving them vocabulary words or telling

> them to just read this passage. No, it's very important that science is ongoing-an action thing. More so, that hey we need to make sure that even though ultimately the standards are needed for the students to learn, but that we don't just emphasize testing. More so, [tell students] let's learn these standards so they can follow you through life.

Audrey, too, believed standards and state assessment assisted her with preparing students for careers in science. According to Audrey, the technology she utilized to teach standards and prepare for state assessment assisted her most for this preparation of students. Audrey shared,

> So, actually we focus on that [standards and state assessments] because test-taking strategies are important. And even with that, I notice with testing that we're getting away from paper-and-pencil. And so it's more technology now. So that's something to share with them as well. That everything is just changing. The world. You know. That technology. That STEM. All that is coming in there. And like I said, it's a technology world nowadays.

Felicia stated she used the standards and state assessment as a recognition tool to potentially help her to identify students that are interested in STEM careers. According to Felicia,

> I think that's kind of what it gears them towards. It gears kids towards having some opportunities in those fields. And you can kind of tell if kids go towards those fields or not. If they really take an interest in it, you know, that might be where they might want to go when they are growing up. So, I think if you didn't

> have science and those standards and have it out there for them, I don't think they would know what they like or didn't like. They wouldn't have those choices. Some kids love science and some just don't. They're not crazy about it. Then I have I would say 75% of kids that love it. Which is just awesome. And everything is just new to them. We get to dive deeper into weather. We dive deeper into energy than they ever have before in sixth grade. And so they go, "Oh, that's why that's working that way!", "Oh, that's why that happens!" I think it's good for them, because they get to find more about it as they age with the science curriculum. Because they put it in there. So, you do have to dive deeper into the concepts. So, that's the State Department doing that.

In addition, Blanche and Ann viewed the standards and state assessments as a teacher accountability measure. Blanche said, "Well, it keeps me on my toes … But I do think it drives my lesson and I make sure I cover everything I'm supposed to cover and more." Ann concurred, "State standards keep me on target for the things that I have to teach the students." However, Ann believed only the standards had any impact on her preparation of students for careers in science.

On the other end of the spectrum were teachers who believed there are too many standards to properly prepare students for STEM careers. A third category that emerged was standards and state assessments deplete time. According to teachers, this was time that could otherwise be earmarked for such preparation. In regards to the third category, Albert expressed,

> Alright, so teaching towards the things that deal with testing takes away from the stuff that we can do as it relates to like integrating STEM and science. Because we have to be on this schedule or teaching to these standards. Even though the standards are important, it takes away from all that you can do. You have to get through these standards in a specific time frame. And there are little areas that you probably wanted to like expose students to, but you can't because you have to teach those standards. And, they [standards] are more important than STEM. So teaching within the standards are important and makes it difficult to integrate what is pretty much crucial to STEM and science.

Betty, however, believed not only does standards and state assessment deplete time, but indicated she had seen science completely neglected in favor of tested subjects. Betty felt,

> I would say testing does not lead to preparing our kids for what science is all about in the real world so to speak. If we are not tested on it in that grade level, they always put it on the back burner. So, I don't think testing is the thing that's going to make everybody engage in science and STEM. Our curriculum is geared towards that. But I don't think our teachers are well-prepared for that embracing of STEM and technology class. I don't think our teachers are there. We train them for everything, but what they could do. So, I don't believe testing definitely is the answer. I don't think our teachers are prepared to embrace STEM, the curriculum, and the careers that go with that as they should be. Or, as they could be if more focus was on that.

Ashley also expressed a disconnection between the standards and the focus on STEM careers. Ashley believed, “Embedded in the state standards are indicators that include opportunities for students to participate in STEM activities. However, the focus on STEM careers is not apparent to me.” Blanche added, “But, there are times I think they should not be as many standards, because it will give you more time to work on a specific unit instead of keeping the pace with how many standards that you have.”

In succinct, a major category that emerged was six of the 10 teacher participants believed standards and state assessments were actually aligned with preparing students for careers in careers in science. A second major category that emerged was the connecting of standards to tangible STEM careers. A third major category that emerged was too many standards and state assessments deplete time.

Interview Question 6 asked, “What influence would you describe your administration as having on your integration of STEM career-related lessons into the science courses you teach?”

The majority of the teachers believed administrators encouraged them to integrate STEM activities into their lessons, provide opportunities for teachers to engage in STEM training, and foster a STEM culture. Ashley stated: “Administrators encourage us teachers to integrate hands on STEM activities in the classroom and apply it to real life by talking about future careers related to STEM.” Billy, also, felt encouragement from his administration to integrate STEM career-related lessons into his science courses. Billy indicated,

> A lot of time my administration are actually supportive of the STEM community. A lot of times, I have attended science conferences they have asked me to attend. On March 15th, 2018, I was just down in [a city in the southeastern United States] for a science conference-a STEM conference. And it was pretty informational for me, because I learn something daily dealing with STEM. We have many different PLOs [Professional Learning Opportunities] during the year especially in the state of [anonymous study site] like three or four where we get credits and it's pretty beneficial for the teacher. I would say that the trip to [city in the southeastern United States] was a rare showing for the simple fact that the way STEM is important now, it wasn't as important my first year teaching. I know that the administration we have had in my 3.5 year teaching career are supportive. I have noticed professional opportunities for science more so than math. Both are important. I know more so for science. They have been giving me different opportunities for the past year and a half which I have been blessed and honored to be able to actually go to these conferences and professional developments that will better enhance my abilities. To me, even those my teaching career is short, for the past year and a half, they pretty much have been giving me opportunities to broaden my perspectives.

Audrey shared,

> Well, actually for the group that we have, they are encouraging, because they are always encouraging us to do things and try different things with them. And [they are] encouraging us to expose them to things outside of school like field trips and

> certain things of that nature. So they try to reinforce it and encourage us to do things.

Thus, a major category that emerged was administration's passions spearheaded the climate of STEM or lack thereof. However, the teachers expressed the additional support they crave for with respect to administration support was lackluster at best. Therefore, a second theme that emerged was teachers yearn for administration's support in their efforts to integrate STEM career-related lessons during science instruction. Sarah expressed,

> [Administrators have] A very big influence. We have a multi-million dollar STEM lab at the school. So that there shows that administration is on board. But then again, I think that the administration is not understanding or maybe they don't know how to obtain resources at an early age. Kids need to be Pre-K playing around with STEM concepts and projects. Being here for 11 years, I'm noticing that kids think projects are different from what the reality is. Most children think projects are something written on a poster board or something. They're not really looking at design. The administration rarely says anything. They don't really put their money where their mouth is when it comes to kids or things that really align with what people in STEM are doing. I think they embrace it. I think they welcome it, but it has to be on someone else's dime. Like if you can get the money as a teacher that's fine. I don't think they shy away from it or anything like that. But they put too much responsibility on the teacher, I believe. But the overarching permissions are in place.

Betty voiced,

> I think they set the mood for what happens as instruction or curriculum or the importance of whatever subject it may be. I believe they set that mood. When science became important at one time, you had the science coaches. You had the math coaches. That was the focus. You could go to any school and you saw that happening. Ok. When either the grant was over or they decided to put their money somewhere else as in reading coaches or anything like that, then you saw the shift. So administrators, whether it's district leadership, or whether it's school leadership, they set that wheel in motion to what they think is important. If a principal was a science teacher, if that was his or her love you would see that within the school. If math or ELA [English Language Arts] or whatever if that was their love, you would see more of that. So, it depends on what the push for the district is or what the push is school wide is. That's what you will see more of. You will see more focus in that department. So, I think we have a grand responsibility when it comes to making sure students get a complete education when it comes to the different, not just math, not just ELA, but everything-especially our sciences. Because we don't do science justice. Especially the lower grade levels. And any grade levels where you may not have state testing. So, I think our district personnel and our school personnel when it comes to that, plays an important role in that. And just setting that mood. And setting that tone within the school. And expressing how important science is. Making sure we don't take

> out the science. Making sure we keep the science. Make sure that time is protected. I think that's very important.

Felicia said,

> I don't know if they know about it. We used to have a science curriculum coordinator and she was more just into getting your standards and your lesson plans done. Getting just how it pertains to jobs-probably not enough. You know what I mean? Because they're probably a lot more field trips and stuff we could probably go on based on that if that was something of more importance. If the school thought it was more important, we would probably plan more field trips.

In summary, a major category that emerged was administration's passions spearhead the climate of STEM or lack thereof. A second category that emerged was teachers yearn for administration's support in their efforts to integrate STEM career-related lessons during science instruction.

Interview Question 7 asked, "What information does the textbook and instructional materials you use include about science careers?"

Teacher participants shared differing experiences with the science textbook. One experience teacher participants did seem to agree on was the textbook alone was not adequate for preparing students for science careers. A major category that emerged was the adequate inclusion of science careers must go beyond the textbook. Teachers indicated the newer textbooks they used included sections about science careers. Ashley did not believe the careers in the textbook were "necessarily STEM careers." Karen shared similar thoughts. Karen indicated,

> The textbook we're using this year is the first year we've had it. It actually has STEM activities built into it. They call them STEM checks, but you actually look at them, they're really not STEM activities. They really don't classify as a STEM activity once you really get into them and look at them. It's more of a craft that doesn't actually have that exploration and ability to manipulate things. But they do have it.

> From the responses, it seemed Albert, Ann, Sarah, and Billy would disagree. All four teacher participants believed the textbook did due diligence to the integration of science careers. According to Albert,

>> So, the Pearson textbook that we use pretty much integrates a lot of like STEM and science careers. And the introduction of each lesson tends to talk about different science careers, the medical field, and engineering. So, the kids pretty much get a little exposure from their textbook or the instructional material we use.

Ann had found, "The textbook highlights areas of careers in almost every section." Audrey also saw the correlation between science careers and the textbook when we were "talking about the weather and it pulls in with the different careers." Sarah had a similar experience with the science textbook she uses in her science courses. Sarah said,

> Well, I know our text by McGraw-Hill is topped with STEM all through it. [You can see this] Just by [looking] the table of contents and the index. I mean I've gone through that book and that're always citing either an inventor, a concept, or some kind of relevance to STEM. So the books are good. They're very good.

Billy, however, only agreed to a certain extent. Billy believed the science textbook to be a primary source for introducing STEM careers; however, teachers need to supplement the science textbook with additional resources. Billy perceived,

> A lot of times in the textbook they have some aspects about the careers in science, technology, and math. They have many different articles or little readings at the beginning of each chapter. And a lot of times they talk about the different careers that use these tools. A lot of times they may be talking about the job of an astronaut. What does an astronaut do? We are currently working on that. When I talk about STEM, I'll tell them astronauts don't just go out of space. That's what they know. That's what they understand. We actually talk about what they actually do. I actually give them the opportunity to actually research. A lot of times I put my students in groups to do research on their own for students to understand the different careers they are. The textbook may give them some of the information, but I try to do an extension of the textbook so that the student can get a better understanding of the skill or standard they are learning. They can actually put that skill or standard to a career or information with STEM.

One resource Betty believed teachers should use as source of information was themselves. Betty expressed,

> I believe it's going to have to be more teacher. The teacher is going to have to have more physical curriculum implementation of what they think or what they know from what the curriculum states they need to do. I haven't found a textbook that actually does that. So, that's why making sure they're doing their research

> and using their kits and pulling STEM activities that are out there and making sure we're embracing the careers that's out there. I think that's going to be the key. No textbook at all. Just making sure they understand what the curriculum is speaking of, what the standards are asking you to do, how the standards are asking you to relay the information, what the students are responsible for learning, and what they are responsible for doing. Just understanding the curriculum and the standards. Especially the STEM. Making sure they are doing that. Embracing that in their curriculum. …So, I would say no textbook. I haven't found one yet.

Felicia believed real-world discussions to be among the best practices for supplementing the little STEM information she did see in her science textbook. Felicia said,

> When they can relate it to the real world, they're more interested. So, I try to look for that help. Well, farmers use scientific investigation when they're planting plants. You know what I mean? I always try to find stuff on the Internet to make it relatable to how real life people would use this information. You know? Because farmers use weather too. Farmers have to track weather and they have like these systems that can helps them track weather on which fields will get water. And they buy those. And it's like a mini-satellite system for a farmer.

Blanche, too, expressed the necessity to supplement the textbook with teacher-secured information. Blanche confessed,

> Well, the science textbooks that I have now are the ones we had when we left our old school and we left our old school back in 2008. And some of the other grade

> levels have been given the opportunity to use the new textbook online, but my grade level has still been using the same old book since 2008. So, I don't use the book as much. I use it more so to show them pictures of certain information. We mostly use online tools that I find on my own or different material that I bring in. But, the textbook that I have is very old so there isn't much STEM in there at all.

In succinct, a major category that emerged was the adequate inclusion of science careers must go beyond the textbook. STEM careers are not black and white and so for teacher participants, restricting students to learning about science careers only through the black and white print of a textbook was a disservice. While teachers expressed the newer textbooks at least made mention of science careers, the majority of teachers reported additional measures undertaken to provide STEM career-based information. Interview Question 8 asked, "How do you describe your capability to integrate information about STEM careers into the science courses you teach?"

All of the teacher participants articulated being capable of integrating information about STEM careers into the science courses they taught. Many of the teacher participants described this capability as being able to at least discuss some aspect of STEM careers with students. Several teacher participants felt their capability to integrate information about STEM careers into the science courses they taught was enhanced through professional developments and technology. Although capable of integrating information about STEM careers into the science courses they taught, several of the teacher participants felt they would be better capable if they were provided with additional administrative support, STEM career training, a decrease in other teacher responsibilities, and had more funding. Billy admitted as a new teacher he has seen a shift in his confidence over the span of his teaching career. Billy said,

> To be honest with you, when I first started teaching I actually was afraid of science. I was actually going through the transition from the old [anonymous study site] standards to the newer [anonymous study site] standards. It was very scary to me. It was actually scary to teach. I actually was not that confident in my teaching ability to teach science. Those new standards took me for a little loop. Being able to get professional developments, going to those conferences have really broadened my confidence when it comes to teaching my students about the STEM community. My first year teaching, I was not confident in my ability to teach science at all. As the years went along, I have definitely become very, very, very, very confident. I feel good about my capability to teach science. Especially since now, I understand in science you have to learn by doing and not just by reading and things of that nature. So, I would say I have grown a lot in my capability. At the beginning, I was in restriction. Now you know, I am very excited when we do certain things. I am actually not nervous. I don't want the children to mess up anything. Or, I don't want them to hurt themselves or things of that nature. At this point now, this is my third year teaching. I very confident in my capability to teach science. Yet, I'm still learning.

The learning Billy attributed to his increase in capability level was one other teacher participants had experienced as well. Additional teachers also described the impact professional development, personal research, and continued learning have had on their success. Sarah noted,

> I work with scientists every year of varying disciplines. I take a class with NASA every summer. I try to go for the top agencies in STEM. I worked with Boeing, the chemical society, geology, aviation, the ocean people here, and the Savannah River site. I have networks all over the state. I'm always one of those continuing education people.

A major category that emerged in response to this interview question was teachers were capable of integrating STEM career-related lessons during science instruction. For teachers who had a strong intent to integrate STEM career-related lessons during science instruction, teachers would seek out additional means to enhance their levels of capability. Thus, a second category that emerged was teachers were receptive of additional training and support.

Reflective Journal Question 1 inquired, "What successes and challenges have you had with fulfilling your intentions to integrate STEM career-related lessons into the science courses you teach?"

Despite teachers expressing capability to integrate STEM career-related lessons into the science courses taught, the teacher participants named only a few successes. The successes that were named were ability to implement project-based learning, partnerships, and test results. A major category that emerged in alignment with the main successes teacher participants described were student engagement. A subsequent category teacher participants shared were students expressing interest in various STEM careers as a result of their exposure to STEM professionals in their science courses. One teacher participant, Betty, explained the feeling she experienced when students actually learn for themselves. Betty expressed,

> Even if it [the project] doesn't turn out the way I may have wanted it to turn out or even when the students realize that what they thought would have happened didn't, to me that's a learning experience. To me that's a victory. Because their failures only emphasize they're scientists that have done things over and over again. No one gets it right the first time. And for them to have that opportunity to witness that thing they were doing and then when they do get it, it's an "a ha" opportunity for me. That's a positive. That's a learning experience. That's a victory.

Another teacher, Blanche, shared similar sentiments. Blanche said for her success comes from,

> The reward is them knowing the information, giving it back to me without me, most times, without me having to even ask. Them working with their peers and explaining what they've learned and proving to each other through constructive arguments who's right and who's wrong. And they have to prove it, because we don't just go with what somebody says we have to find facts and research.

> As a result of project-based activities and discussions had in science courses, many teachers indicated students have expressed interest in STEM careers. Audrey has heard students say, "I want to do certain things because of the fact of the STEM classes that we talked about. I even had some of them say that they wanted to be math teachers."

Felicia believed the ability to go on more field trips would expose students to more STEM careers. However, Felicia identified the inability to go on more field trips as one of her biggest challenges. Felicia said,

> I tried to go see the hydroelectric power plant, but they closed it and wouldn't let you see it. So, I've had that kind of trouble, too. There are places you need to go to expose children that they won't let you go to. Or maybe, even knowing where to go on field trips for those particular careers in science.

Additional challenges teachers named as affecting their intentions to fulfill their intent to integrate STEM career-related lessons into science courses included lack of administrative support, being required to teach to the standards, students' low reading levels, students' fear of other cultures, the disconnect between home and school, lack of funding, limited resources, and ability to differentiate instruction. A third major category as a result of teachers' accountings was time. According to Ashley,

> It seems there is not enough time to incorporate STEM and STEM careers into science instruction like I would like, because there are many standards and indicators that need to be taught besides just STEM.

The issues with the scarcity of time was something other teachers reported as well. Ann, for example, said,

> I see my science students every other day so it is hard to continue a lesson the next day. When the students come back to me, I have to spend more time reviewing what was covered the day before.

Betty also described similar challenges with time as a self-contained teacher. A self-contained teacher could be described as a teacher responsible for teaching all of the core subject areas. Betty expressed,

> I believe I do not put in the time. I don't put in as much time as I should when it comes to the science curriculum and the science STEM, because other subjects are sometimes pushed more than science. I would love to be able to get into the science lab between two and three times a week. There are weeks where we are lucky to get one. And I have spoken with other teachers who don't even get that. So, just the timeframe. ….And now we're getting even less because we're getting ready for state testing so everything is now focusing on just math. So, just having that time. And having that time protected has been a struggle.

Reflective Journal Question 1 yielded three major themes. A major category that emerged in alignment with the main successes teacher participants described were student engagement. A subsequent category teacher participants shared were students expressing interest in various STEM careers as a result of their exposure to STEM professionals in their science courses. A third major category as a result of teachers' accountings was time.

Reflective Journal Question 2 asked, "What are your beliefs about whether you should or should not encourage students in the grade level you teacher to explore science careers?"

A major category that emerged was all teacher participants believed in encouraging students in the grade level they taught to explore science careers. A second category that emerged with the belief exposing students to STEM careers at an early age opened students up to endless possibilities in their later lives. Betty indicated, “I don’t think there’s any age that’s too early to think about what they want to be when they grow up.” Albert added, “Getting exposed to the variety of career STEM offers pretty much at this early age or at stage is very important. Because who knows at the end of the day it’s probably something they end up going into because of being exposed to it so early.” Betty also favored teachers having conversations about varying STEM careers. Betty indicated,

> [I want to] get them [students] thinking about exactly what they may want to do as they grow up. They [Students] always talk about the doctor or they might talk about the firemen. [It helps]When you bring in different career opportunities where they can see men and women are doing different things, because you usually think about science as more of a male-dominant occupation. Just getting the females involved in science, I think is very important. Even at my grade level, opening the window, or opening the idea of what’s out there other than the firemen is very important.

Albert continued, “Because as I said earlier science careers are underperforming. And some of these kids don’t know that STEM doesn’t have to be scientific. Agriculture would also fall under STEM careers.” Ashley expressed, “Science careers are in high demand and can be very lucrative. By encouraging students to explore science careers they will have a good shot at being employed, contributing members of society.” Audrey believed “the science, and technology, and all this stuff is taking over.” Sarah seemed to share a similar ideology as she stated,

> I want our children to be on a level playing field with the internationals. I want them to know what’s coming. I do a lot of reading. I do research about careers that are up and coming and I just want the kids to be aware of that and not be afraid. Because there is so much mediocre in this world. I want them to be risk-takers. Because most of the STEM careers are involving risk. I mean at least low risk where you have to stand behind an idea or design a proposal.”

Ann expressed, “I want the students to know that they can have a career just like those individuals they read about and be happy going to work every day while making a decent salary.” The job satisfaction associated with STEM careers was one of the main things Billy told his students to peak their interest in STEM careers. Billy indicted,

> A lot of times I have individuals that I know for myself who are in the field of engineering that are close to me and I talk about how even though it is a career, it’s so fun to them, so fulfilling, and enjoyable. They don’t look at it like work. I express to my children that a lot of times these types careers these individuals are a part of is something they want to do their entire life. It’s almost like having a good time.

Felicia and Blanche both thought encouraging students at their respective grade levels to explore STEM careers would prove beneficial for the environment. According to Felicia,

> I think in the long run this is something they are going to enjoy and love and it's going to be better for the planet. And they're going to do something that's going to help our world. Usually when you get into science, it's something about preserving our planet, or using creativity or thinking outside the box.

Blanche added,

> Everything is more technology-driven now. Science is a big part of our world where we are trying to improve things. This is the generation now where things are going to really be changing very soon. And, it's time to make those changes before things happen. We need to go ahead and be proactive. There may be global warming. Of course, the Earth is warming up too early, too soon, faster than what we want. So, therefore we are going to see these snowstorms and different things, because we have scientists working on these things to cool off the Earth faster than waiting on it to heat it too fast. So, these students have to be able to think critically and analyze data and things like that. So, we have to get them to be more involved in science.

Thus, another category that emerged was teachers wanted to encourage students to STEM so students might become productive, contributing members of society. In summary, a total of three categories emerged in response to Reflective Journal Question 2. The first major category that emerged was all teacher participants believed in encouraging students in the grade level they taught to explore science careers. A second category that emerged was the belief that exposing students to STEM careers at an early age opens students up to endless possibilities in their later lives. The last category that emerged was teachers wanted to encourage students in STEM so students might become productive, contributing members of society.

Reflective Journal Question 3 asked, “What specific factors and/or needed resources do you see as enabling or preventing your intention to integrate STEM career-related lessons during science instruction?”

Teacher participants described technology as enabling their intention to integrate STEM career-related lessons during science instruction. Ann believed the fact her school district offers 1:1 technology was a wonderful support as a middle-grade science teacher. 1:1 technology referred to the availability of one technological device (i.e. Chromebook, IPad, etc.,) for each student. Specifically Ann stated,

> Having Chrome books in the classroom is a wonderful resource that enables me to bring the world to my students in the classroom. It allows us to research the things that we have questions about and work with interactive websites. Having the Chrome books, I see STEM moving forward in my classroom.

Audrey also believed technology assisted her with the integration of STEM career-related lessons during science instruction. Audrey expressed, “A lot of times when I want to show them something I usually try to find a video or something to kind of get their interest, to let them see what I getting ready to engage them in so they can kind of say, ‘Oh, you know what we really need to know this’.”

Like Ann and Audrey, Karen also taught in a school with 1:1 technology. However, Karen had a different perspective on the usefulness of technology. Karen stated, “I like doing projects with materials and my hands instead of doing it on an IPad. I believe computers take these experiences away from students." However, Albert, Ann, and Felicia named lack of technology as one of their challenges with integrating STEM career-related lessons during science instruction. Albert stated,

> In our district, we are not 1:1. So, it's somewhat difficult. We have laptop carts. It is spread across the entire school and we have like 5 laptop carts. And we have over 10 teachers. It is always a bit of a challenge to get the children the technology so we can explore.

Thus, a major category that emerged was teachers viewed technology as enabling to the integration of STEM career-related lessons into science instruction. A second major category that emerged was time as a prevention to the integration of STEM career-related lessons into science instruction. Ashley believed, "If I had more time to focus on STEM and less standards to teach, I believe I would be more effective as science teacher." Billy also mentioned time being a preventing factor in his response. According to Billy, "Anytime you are teaching any type of STEM activity, subject or concept, you don't have as much time as you have with your core subjects such as math or ELA."

Betty strongly believed that time was a crucial factor that could alleviate a lot of different challenges teachers face when attempting to implement their intention to integrate STEM career-related lessons into science courses. One element Betty regretted not being able to have due to time constraints were professional conversations with other teachers. According to Betty,

> The time-constraint would be one of them. We are a very small school so being able to have conversations with other science teachers is very important. And as a

small school sometimes you don't have those opportunities where teachers can bounce ideas off each other where teachers can sit and plan and talk about what worked, what didn't work, how can I make it different? What could I have done? I bombed out today. What else can I do? Just having those professional conversations I think would be important. As far as resources, teachers are probably their best resource, because they find out things and they can share it. So, just those conversations. There is money out there. So, if you found out there's a grant out there. There's something that's out there. Donor's Choose or whatever. And you share that with other teachers how powerful is that?

Time constraints for not being able to do as much as you could with your kids and being able to have professional conversations with other teachers within your grade level or a grade level above or below is as a prevention.

Betty also believed the issue with time coupled with the geographical isolation of rural schools had a dire impact on what teachers could provide for students to further fulfill teachers' intentions to integrate STEM career-related lessons into science instruction. Betty continued,

Having that time is very important as well. But, we are a small school. We used to have a grocery store. We don't even have a grocery store any more. But there're no factories. There's no businesses that we could pull from that deal with careers in STEM. If we do, it would be someone from [anonymous study site] or someone from [anonymous study site]. And not very often those people are willing to come and drive 35 minutes, 45 minutes, or an hour here. We have one partner. I believe

> that has a lot to do with it too, because the kids are not seeing these type of individuals in these types of jobs.

Sarah concurred with Betty on the necessity of time to collaborate. According to Sarah, “It [The integration of STEM career-related lessons during science instruction] requires collaboration with different cultures.” Collaboration was a topic several other teacher participants mentioned as well. Billy, for instance, mentioned the necessity for cross-curricular collaboration among teachers. According to Billy, “also, sometimes certain teachers may not put as much emphasis on the science and the math.”

Billy added, “Our English and Social Studies also needs to be incorporated into STEM. Those things may be frowned upon, but every subject that you learn can help you in STEM careers.” Felicia confessed “a lack of knowledge of what careers go with STEM and the standards we have. I know some, but I’m sure they are a lot more.” Audrey shared similar thoughts.

According to Audrey, “We’re doing it [collaborating], but there’s always room for improvement.” Audrey expressed interest in collaborating with business partners so students could do job shadowing. Audrey stated, “Job shadowing is very beneficial to our children as well.” From Audrey’s viewpoint, job shadowing could help empower her students to think about what’s in the community.

> So you [students] can help better your [their] community. If not, depending on what your [the student’s] major is you [the student] have [has] to leave. But with the things that are here, we try to get them [students] to think about what’s in your [the students’] community or what’s in our community so that we can help bring

> benefit on others. Like I told them a lot of people think only about going out of town or whatever to go to school. I tell students to stay here, build your [their] community instead of going somewhere else and building up someone else's community. But the most important thing is that if you wanted to work to Zeus or whatever-certain places knowing what it is that you would have to know what to do in order to be successful on that job.

Thus, a third category that emerged was the importance of collaboration. In succinct, three categories emerged in relation to Reflective Journal Question 3. These three categories were technology enabled teachers' intention to integrate STEM career-related lessons during science instruction, time prevented such integration, and collaboration was important to the integration of STEM career-related lessons during science instruction. A synopsis of the categories that emerged in response to the data analysis of teacher participant responses to the interview questions and reflective journal questions appeared in Table 3.

Table 3

Synopsis of Categories from Data Analysis

Interview Question	Emerging Categories
IQ1: Intention to integrate	Believed in integration STEM activities assisted Routinely engaged students in STEM discussions Bringing in of external sources
IQ2: Teacher role/frequency of integration	Should be student-centered Should be in regular intervals Teacher as facilitator
IQ3: Beliefs about integration of information	STEM careers important Creating a love of science STEM careers as an attainable goal
IQ4: Teachers' responsibility	Should be teachers' responsibility Making science appealing to all students
IQ5: State standards and assessments	Aligned with STEM career preparation Connection to tangible STEM careers Too many deplete preparation time
IQ6: Administrative influence	Administrator's passions spearhead STEM climate or lack thereof Teachers welcome administrative influence
IQ7: Textbook/Instructional materials	Must extend beyond the textbook Additional measures undertaken to provide STEM career information
IQ8: Capability	Teachers are capable Teachers receptive to additional training and support
Reflective Journal Questions	Categories
RJQ1: Successes/Challenges	Student engagement Students expressing interest Time
RJQ2: Encouragement of students	Teachers believed in encouraging Opens students up to endless future possibilities Producing productive, contributing members of society
RJQ3: Enabling/Preventing Intentions	Importance of collaboration Technology enabled teachers' intentions Time prevented integration

Step 3: Clustering and Developing Themes

From these categories, the following themes were found in regards to rural elementary and middle-grade science teachers' intentions to integrate STEM careers.

Theme 1: Rural elementary and middle-grade science teachers perceived it their responsibility to facilitate the integration of STEM career-related lessons during science instruction through student-centered, STEM activities, the regular engagement of students in STEM discussions, the bringing in of external sources, creating a love of science, presenting STEM careers as an attainable goal, and making science appealing to all students.

Theme 2: Factors that affected rural elementary and middle-grade science teachers' intention to integrate STEM career-related lessons during science instruction included: (a) state standards and assessments, (b) administrative influence, (c) time, (d) collaboration opportunities, (e) technology, (f) receptivity to additional training and support, and (g) availability of resources.

Theme 3: Rural elementary and middle-grades science teachers perceived intentions to integrate STEM career-related lessons during science instruction were a success when students were engaged, and students expressed interest in STEM careers.

Theme 4: Rural elementary and middle-grades science teachers believed the integration of STEM career-related lessons during science instruction to be important in opening students up to endless future opportunities, and in producing productive, contributing members of society.

Step 4: Validating the Themes

I validated each theme by physically examining each theme with the transcribed data from the teacher participants' responses to the interview questions and reflective journal entries. The information I examined were interview transcripts, reflective journal entries, my analyzed data, and categories created for each of the interview questions and reflective journal entries. I then matched each theme to each source of data. I eliminated themes I could not match to the data, the analysis of the data sources, or that was determined irrelevant to rural elementary and middle-grades teachers' intention to integrate STEM career-related lessons.

Step 5: Individual Textural Descriptions

In this step, I used the reported perceptions of rural elementary and middle-grades science teachers to construct individual textural descriptions that correlated with the four themes that emerged in Step 4. To support the individual textural descriptions, I used at least five participants' verbatim responses to the interview questions and reflective journal entries for each of the four themes.

Theme 1: The first theme was rural elementary and middle-grade science teachers perceived it their responsibility to facilitate the integration of STEM career-related lessons during science instruction through (a) student-centered, STEM activities, (b) regular engagement of students in STEM discussions, (c) the bringing in of external sources, (d) creating a love of science, (e) presenting STEM careers as an attainable goal, and (f) making science appealing to all students.

Albert. In relation to the theme about responsibility perceptions, Albert believed it his responsibility to facilitate the integration of STEM career-related lessons during science instruction. Albert viewed the facilitation of science courses to be a critical factor in opening students up in the rural areas he serves to new careers. Without assuming the facilitator role as a teacher, Albert believed students may not even know certain STEM careers exist. Albert believed he provided students with an introduction to various STEM careers through hands-on experiences. In addition, Albert believed it to be part of his responsibility to disband negative stereotypes about STEM careers. According to Albert, "STEM can be portrayed as a little bit abstract or it probably comes off as being difficult or that the students have to be smart to be involved in." However, Albert believed making students' hands-on experiences with STEM "more fun and engaging" would encourage students to become more interested in STEM careers.

Sarah. In relation to responsibility perceptions, Sarah believed it her responsibility to facilitate the integration of STEM career-related lessons during science instruction through the regular engagement of students in STEM discussions. Although Sarah admitted it was expensive for her, Sarah prepared herself to engage students in regular discussions about current STEM-related news by participating in fellowships with top agencies (i.e. Boeing, NASA, the Savannah River site) each summer. Sarah believed she needed to undergo this preparation so "that every child has to at least a baseline knowledge of engineering in their science curriculum." Sarah also shared her thoughts that "our infrastructure is depreciating. Engineers or designers and leaders of the old school are getting older. And particularly with technology, students have to get that

STEM knowledge." Therefore, in Sarah's nearly daily conversations with her students Sarah indicated she may lead students in a discussion about the "bridges and roads being torn up" and have students to "discuss what we can do to alleviate that." Also, Sarah believed it her responsibility to facilitate the integration of STEM career-related lessons during science instruction through the bringing in of external sources. Sarah firmly believed students cannot phantom STEM careers they have not heard of. So, when opportunities presented themselves Sarah indicated she has brought in pilots, airplane mechanics, and engineers to further encourage her students to become more interested in STEM careers.

Ann. In relation to responsibility perceptions, Ann believed it her responsibility to facilitate the integration of STEM career-related lessons during science instruction by creating a love of science within her students. Ann believed "when children are taught the basics of STEM and I show the students my love of the field through hands-on activities, the students will develop a love for science too." Ann believed in order to assist students with developing a love of science "teachers must have engaging, exciting, and hands-on experiences." Ann indicated on a daily basis she worked "on adding new things to give students a good taste of the real world of STEM." In addition to hands-on experiences, Ann also believed discussions were a necessity in presenting STEM careers as an attainable goal. Ann used her discussion to encourage students in STEM careers by informing them "that they can have a career just like those individuals they read about and be happy going to work every day while making a decent salary."

Billy. Concerning responsibility perceptions, Billy believed it his responsibility to facilitate the integration of STEM career-related lessons during science instruction by making science appealing to all students. Billy believed bringing in his prior experience as a former computer science major and affiliations with current STEM professionals assisted him in encouraging students in STEM careers. Billy indicated he often encouraged students to make science "a part of what you do every day." Billy added, "You may not like science. Or, science may be boring to you. But, maybe there's something in science that you like." Billy also tried to promote the appealing nature of STEM careers by engaging students in discussions about his close friends that are engineers who are passionate about their careers and are excited to report to work. In addition, Billy encouraged students by incorporating a lot of robotics into his classes and bringing in external sources so the students can see "the different careers in action."

Audrey. In relation to responsibility perceptions, Audrey believed it her responsibility to facilitate the integration of STEM career-related lessons during science instruction by having students to view current trends and the evolution of societal demands. Audrey believed technology was taking over the world. Audrey indicated "with all the technology that's coming up now you have to know how to work technology with everything." To prepare students for society's technological take-over, Audrey believed students must be encouraged to think about the role STEM plays in their everyday lives. Audrey also believed it her responsibility to instill in students the importance of believing in themselves, being proactive with post-K12 career and college goals, and giving back to the community as future STEM professionals.

Thus, the individual textual descriptions offered support to the theme of responsibility perceptions, because teachers believed they can encourage students in STEM careers by facilitating science instruction through student-centered, STEM activities, regular engagement of students in STEM discussions, the bringing in of external sources, creating a love of science, presenting STEM careers as an attainable goal, and making science appealing to all students. They also believed it their responsibility to prepare students for the ever-changing global society and students' future self-sustainability.

Theme 2: Factors that affected rural elementary and middle-grade science teachers' intention to integrate STEM career-related lessons during science instruction included: (a) state standards and assessments, (b) administrative influence, (c) time, (d) collaboration opportunities, (e) technology, (f) receptivity to additional training and support, and (g) availability of resources.

Ashley. In regards to perceptions of the impact of factors, Ashley believed "state standards embed opportunities for students to engage in STEM activities, but does not see an apparent connection to STEM careers within the standards." Ashley believed she is influenced by administrators to incorporate STEM activities into her science courses and to engage students in STEM career discussions. Ashley believed the influence from administrators to be of an encouraging nature. Ashley added, [Administrators] allow us to integrate information related to STEM careers freely." Ashley did report some students had expressed interest in engineering as a result of building things and classroom discussions. In regards to resources, Ashley indicated, "The textbooks in my classroom are very dated and we don't use them often. However, there are a few parts of the textbook that emphasize careers in science, but not necessarily STEM careers." Ashley did report her intention to integrate STEM career-related lessons during science instruction was minimized due to need for additional time. Ashley also added, "There are many standards and indicators that need to be taught besides just STEM."

Betty. Concerning the perceptions of the impact of factors, Betty believed in aligning the state standard to the STEM activity she is engaging students in. However, Betty stated, "I would say testing does not lead to preparing our kids for what science is all about in the real world so to speak." Betty also believed administrators "set the mood for what happens as instruction." Betty reported as a former science coach, she has witnessed science transform from a priority to an option. As a result of this shift, Betty stated, "we don't do science justice. [This injustice is] especially in the lower grade levels. And any grade levels where you may not have state testing." Betty also believed textbooks do not do STEM careers justice. Betty responded,

> Textbook? I don't know what textbooks other districts use, but our textbook I would say does not do justice for that. Does not implement. Does not incorporate a lot of that in the textbook. So, no textbook.

In addition, Betty believed time also influenced her intention to integrate STEM career-related lessons. Betty stated,

> I believe I do not put in the time. I don't put in as much time as I should when it comes to the science curriculum and the science STEM, because other subjects are sometimes pushed more than science. I would love to be able to get into the

> science lab between two and three times a week. There are weeks where we are lucky to get one. And I have spoken with other teachers who don't even get that.

Betty also expressed her discontent with having other teacher obligations that further minimized all that she could possibly do with integrating STEM career-related lessons during science instruction. Betty expressed,

> When you have so much on your plate, it makes it difficult to do any subject the best that you can do. I feel that there are days when I don't do what I should be doing, because of the other things that fall on the plate. I would love to be able to teach science all day.

Betty also expressed she would like to collaborate with other teachers if time allowed.

Felicia. With respect to the perceptions of factors, Felicia believed state standards and assessments prepared students for STEM career possibilities. Felicia doubted her administration knew about STEM or STEM careers. If they did, Felicia believed the administrators at her school would encourage more field trips. Felicia also believed the science textbook she used only provided about "20%" of STEM careers. Felicia indicated, "I always try to find stuff on the Internet to make it relatable to how real life people would use this information." Felicia also admitted her integration of STEM career-related lessons into science instruction "is not as focused." Felicia also noted some of her challenges with STEM career-related lesson integration were "lack of technology, and lack of knowledge of what careers go with STEM and the standards we have." Felicia expressed,

> I know some, but I'm sure they are a lot more. We study weather. You know there's a meteorologist, but I know there is a lot more with weather. People at NASA do weather and they're not all meteorologists. There's so many more careers.

Karen. Regarding the perceptions of factors, Karen believed state standards and assessments were a normal part of the school climate. When asked about administrative influence on her intentions to integrate STEM career-related lessons during science instruction, Karen reacted,

> Oh, man! It's really up to the teacher as far as reaching out to the community. The only thing that [one consolidated school district in one state in the southeastern United States] tells you have to do is that you have to have 3 project grades. And in science, there are 3 projects for every quarter and these are expected to be STEM projects. We don't do take home projects. It's more of teacher choice in working with the children we work with. Because the school-home connection is really low. And sending stuff home even something as simple as homework doesn't get done. So, everything is done at school.

Karen also indicated the science textbook her school recently adopted for school misrepresents crafts as STEM activities. Karen expressed to get her students to "explore and manipulate things" she does a STEM week after state assessments have concluded. She mentioned she had experienced success in her intention to integrate STEM career-related lessons during science instruction by engaging students in engineering-type projects. Some of the projects she named include a Hot Wheels activity and balloon cars.

Karen indicated challenges with differentiation as she serves a special population of behaviorally challenged students in a STEM magnet elementary school setting. Karen also expressed, “It’s hard to get them into hands-on activities”, because her school district mandates teachers allow students a certain amount of time on district-approved websites and her students’ primary interest being electronics and games. Karen believed she could better integrate STEM career-related lessons through hands-on activities and prefers such activities over technology.

Blanche. Concerning factor perceptions, Blanche believed state standards and assessments “keeps her on her toes” in terms of accountability and goal-setting. Blanche believed the influence from the recently appointed administrators at her school to have “not been much at all.” Blanche expressed she liked the sense of trust that she received from her administration and felt if funding existed, she could have “requests for certain things” granted. Blanche responded, “Some of the other grade levels have been given the opportunity to use the new textbook online, but my grade level has still been using the same old book since 2008.” Blanche added, “We mostly use online tools that I find on my own or different material that I bring in.” Blanche cited resources as the only preventive measure she could foresee influencing her intention to integrate STEM career-related lessons during science instruction.

> My only thing that can get in the way sometime is resources. There isn’t much material to use. The budget has been cut this year by half-less than half of what we had last year so therefore there isn’t many material that could be ordered this year. A lot of it would have to come out of my pocket if I were to do something.

> But, I could still tweak it to where it could be done. But, it might be as a demonstration for the entire class. Or, it could be where the students had to be in larger groups to get it done. But, doing STEM in the majority of my lesson I could still make it happen. It's just a matter of getting the materials to do it.

Blanche, also, stated that she did not believe most schools have a problem with science.

> In most school systems, science is not the biggest issue. Reading and math is, which is fine because you have to be able to comprehend and you have to be able to do the math in order to do the science too. So, I think all three of them go hand and hand. For myself, I think I'm going to focus more on reading comprehension skills more than the science inquiry skills only because if you can't comprehend what you're reading or learning, you can't do the inquiry part either.

Thus, the individual textual descriptions offered support to the theme of factor perceptions, because teachers offered state standards and assessments, (b) administrative influence, (c) time, (d) collaboration opportunities, (e) technology, (f) receptivity to additional training and support, and (g) availability of resources as factors that could enable or prevent teachers' intentions to integrate STEM careers. They also believed the focus on science had declined over the years, and that much was left up to teacher interpretation. In addition, teachers' responses indicated a possible need to expand teachers' STEM career knowledge and to integrate additional subjects into STEM.

Theme 3: Rural elementary and middle-grades science teachers perceived intentions to integrate STEM career-related lessons during science instruction were a success when students were engaged, and students expressed interest in STEM careers.

Albert. Concerning perceptions of success, Albert believed his intention to integrate STEM career-related lessons during science instruction had been successful through STEM projects. Albert described having his students complete STEM career projects related to the science concepts the classes were studying. Albert expressed,

> I have been successful in students being able to research, look up, or do projects on different careers. People were studying like Earth, land, history of rocks, geology, and all that. So it [success] does tend to come out when we do research on STEM careers based on chapters.

Betty. Related to success perceptions, Betty explained what it felt like to experience success on the opportunities she does get to take her students to the science lab for a STEM activity. Betty described her feelings as such,

> When I do get there and the students are so engaged, I would definitely say that would be a success. Even if it doesn't turn out the way I may have wanted it to turn out or even when the students realize that what they thought would have happened didn't, to me that's a learning experience. To me that's a victory. Because their failures only emphasize they're scientists that have done things over and over again. No one gets it right the first time. And for them to have that opportunity to witness that thing they were doing and then when they do get it, it's an "a ha" opportunity for me. That's a positive. That's a learning experience. That's a victory.

Audrey. In respect to perceptions of success, Audrey described her success with integrating STEM career-related lessons during science instruction as coming from student conversations. Audrey expressed,

> I see some of them talk about their careers and when they are interested in STEM careers. [I see] the interest that they have after sharing. [Students will say] they want to do certain things because of the fact of the STEM classes that we talked about. I even had some of them say that they wanted to be math teachers. Believe it or not, math is important. I had one I think she said she wanted to go into accounting.

Karen. Concerning success perceptions, Karen indicated certain activities came to her mind when she thought about her success with integrating STEM career-related lessons during science instruction. The first activity Karen thought about was an embryology project that she does with ducks in partnership with 4-H. Karen indicated this activity involved hatching ducks. Karen expressed,

> The ducks we're doing this year, we've done for three years straight. And with having the ducks, we get to learn about the life cycle again as a refresher. And talk about their ecosystem, their habitats, and whether they're abiotic or biotic. I get to hit like three grades of standards just by having those ducks in my room for three weeks. It only takes 30 minutes out of my day. And we're getting three grade levels of information just by having them there.

Another activity Karen mentioned she does that was a big engagement piece for her male students was an activity involving Hot Wheel Tracks. Karen indicated,

> And with the Hot Wheel STEM activity, I have a son, so I just take his Hot Wheel tracks to school. And we look at force and we look at motion. So, we're able to get in those standards. And that's always a big success especially with the boys.

Karen also indicated that she ends her school year with the students making their own cars. Karen shared,

> And then they get to make a car at the end of the year as well with cardboard. And use balloon force to move that car. Whoever wins that race gets a prize and things like that. So, we realize they can be creative. It has some engineering in there and they love that.

Blanche. In regards to success perceptions, Blanche indicated her success comes through seeing her students' progress in her class. According to Blanche,

> The reward is them knowing the information, giving it back to me without me, most times, without me having to even ask. [Also I see success in] them [students] working with their peers and explaining what they've learned and proving to each other through constructive arguments who's right and who's wrong. And they have to prove it, because we don't just go with what somebody says we have to find facts and research. I guess just the reward of me knowing that I've catered to each student's individual needs so they can be successful with learning the material.

Ashley. Related to success perceptions, Ashley said she had experienced success during her instructional periods when her students were excited about the STEM activity they were completing. Ashley found, "Most students enjoy STEM activities that require them to build. This has inspired a lot of discussion about engineering and many of my students have stated that they would like to be engineers when they grow up." Ashley indicated she welcomed those type conversations.

Thus, the individual textual descriptions offered support to the theme of success perceptions, because rural elementary and middle-grades science teachers perceived intentions to integrate STEM career-related lessons during science instruction were a success when students were engaged, and students expressed interest in STEM careers. In addition, teachers' responses indicated students were more engaged when students were allowed to engage in self-discovery, supported in reaching a level of self-efficacy, and self-motivated.

Theme 4: Rural elementary and middle-grades science teachers believed the integration of STEM career-related lessons during science instruction to be important in opening students up to endless future opportunities, and in producing productive, contributing members of society.

Albert. In regards to the importance of STEM perceptions, Albert acknowledged not every student will become "doctors, nurses, pediatricians, and they expect to be." Albert believed in order for students to have a realistic view of their possibilities with STEM careers, students must be "exposed to the variety of careers STEM offer pretty much at this early age." Albert believed in the importance of ensuring students are exposed to a variety of STEM career options at an early age, "[B]ecause who knows at the end of the day it's probably something they end up going into because of being exposed to it so early." Albert also indicated students are not always privy to knowledge of these STEM careers any other way. According to Albert, “They know maybe retail or whatever is going on in their community. So, I am there like the bridge that opens them up to what’s on the other side.”

Ashley. Concerning the importance of STEM perceptions, Ashley recognized, “Science careers are in high demand and can be very lucrative. By encouraging students to explore science careers they will have a good start of being employed, contributing members to society.” Ashley believed she conveyed this message to her students during her class discussions. Ashley indicated, “After completing a STEM activity, we discuss how it is relevant in real life concerning skills, jobs, and careers.” Ashley believed these class discussions to be of importance in particular for “students who have a passion for math, science, and/or engineering so they are informed of future possibilities concerning their jobs and careers.”

Felicia. In respect to the importance of STEM perceptions, Felicia believed, “I think it’s important that kids know this, because they’ve got to realize that these STEM jobs and the things we are teaching are possible jobs for them. If you don’t open up to them and let them know, they don’t have that idea.” Felicia indicated she recently heard about a TV program called *The Zoo* that she shared with her students. Felicia explained,

> And so this show called *The Zoo*, I’ve been telling kids about it. These zoo keepers, they don’t just take care of animals and feed them. They have to do tests on them. And they have to know how to breed them. They have to know how to do all of these things and they have to know their species. They have to know how they mate and what makes them be able to reproduce and make more of

> them. They have a hard concept of that. So, we have to use things like that to bring in real-life jobs that makes it more relatable to them. So, I do that all the time either through videos or by discussing it with them.

Felicia continued stating the videos and classroom discussions are,

> Just to try to give them an overview, because we live in a small town so they don't get to get out and see all the other jobs that are out there. Then, we talk about energy. Energy is one of the biggest ones we have with jobs. You can talk about jobs like working in power plants. We talk about engineers. We talk about all the different people in construction talking about levers and machines. So, we have to bring all that in a lot of times to teach what we're doing.

Betty. Concerning the importance of STEM career perceptions, Betty believed her school's career day opened her students up to the endless possibilities of STEM careers. Betty also reported "pulling just different types of careers" to have her students to research and discuss. Betty felt this aspect was important in assisting the students in making connections until the students' minds could fully grasp the entirety of the message Betty was attempting to convey. Betty asserted,

> So they can see how whether it's a biologist or whether zoologist or just different types of scientists, mathematicians as well that's out there that leads to the discoveries that happen in our everyday lives. I don't think they fully understand, because it's third grade you know. Their minds are not completely developed as if they were fifth or sixth graders. But I want them to see the connections, just you know, mainly by itself. Or, how we can come up with different things. We have

> done electricity. And how scientists have used that technology and how things have changed from the sense of our televisions of the 1980s into the televisions we have today. So just giving them that connection whether its electricians or just whatever careers that's out there that helps us throughout the years just seeing how things have changed.

Sarah. Concerning the importance of STEM career perceptions, Sarah believed teaching students to engage in critical thinking exposed students to endless future STEM career possibilities and oriented them to be productive, contributing members of society. Sarah expressed,

> For example, one of their studies is weather and weathering does a lot of damage particularly in [anonymous study site] because there is a lot of water. There's an ocean. They felt really kind of close to Hurricane Katrina. They have a little bit of knowledge of it. But stuff like that. What are levies? What are dams? How can we regulate water flow? How can we redirect things so they won't be damaged by these natural disasters? So we do discuss that, but almost every day I bring up something that has to do with the Earth. Mechanical engineering because they're studying energy. Civil engineering because of weather and everything. They have to do a little bit with electrical engineering, because they are studying electrical energy and magnetism. So, we discuss the purpose of magnets.

Sarah also believed students needed to be assisted in preparing for a potential career in STEM the American culture does not normally prepare them for. Sarah believed it crucial to clarify misconceptions about the simplicity of STEM that "a lot of people think we can just have pictures and match them and everything." Crediting her yearly work in a lab, Sarah indicated,

> I'm looking at the reality of particularly African-American students and lack of exposure. When I was teaching robotics to students; people were afraid of the discipline, critical thinking and analysis. And a lot of our students because they are not for sitting still for long periods of time, they are not prepared to just look at something, take notes, look at it, and take pictures. Also they are not risk takers. A lot of them are concrete learners and if they don't see, it doesn't exist to them yet. Kids need to be Pre-K playing around with STEM concepts and projects. Being here for 11 years, I'm noticing that kids think projects are different from what the reality is. Most children think projects are something written on a poster board or something. They're not really looking at design. Because there is so much mediocre in this world. I want them to be risk-takers. Because most of the STEM careers are involving risk. I mean at least low risk where you have to stand behind an idea or design a proposal. And our kids do not want to be wrong. They do not want to be called dumb. And that is a big challenge because they don't want to try it and fail. In most of your STEM careers, you have to fail sometimes.

Sarah added,

> And I also noticed there is a fear of other cultures. If you look at the STEM careers, STEM careers are heavily populated by Indians, Asians, and Africans and the kids a lot of times are not exposed to those cultures. I want our children to be on a level playing field with the internationals. I want them to know what's

coming. I do a lot of reading. I do research about careers that are up and coming and I just want the kids to be aware of that and not be afraid.

Thus, the individual textual descriptions offered support to the theme of the importance of STEM career integration, because rural elementary and middle-grades science teachers believed the integration of STEM career-related lessons during science instruction to be important in opening students up to endless future opportunities, and in producing productive, contributing members of society. In addition, teachers' responses indicated students may need more exposure to STEM career professionals, opportunities to engage in critical thinking, and understanding of failure as part of the inquiry process.

Step 6. Individual Structural Descriptions

For this step, I created individual structural descriptions to capture the essence of rural science educators lived experiences with integrating STEM career-related lessons during science instruction. I based these individual structural descriptions on teacher participants' accountings of their perceptions related to themes developed in Step 5.

Theme 1: Rural elementary and middle-grade science teachers perceived it their responsibility to facilitate the integration of STEM career-related lessons during science instruction through student-centered, STEM activities, the regular engagement of students in STEM discussions, the bringing in of external sources, creating a love of science, presenting STEM careers as an attainable goal, and making science appealing to all students.

Albert. In relation to the theme about responsibility perceptions, Albert believed the use of fun and engaging STEM activities were crucial in building his students' STEM career interest. Albert was passionate about STEM career-related lesson integration during his science instruction, because he believed his intentions were aligned with the needs of community where he teaches. Albert believed without him taking on the responsibility to integrate STEM career-related lessons his students may not learn it elsewhere. Albert believed every student was worthy of at least an introduction of STEM careers. Albert seemed to be motivated by the agrarian community he served to produce his introduction to STEM careers through hands-on experiences.

Sarah. In relation to responsibility perceptions, Sarah believed regular STEM-related discussions and exposing students to various STEM professionals would result in increases in students' interest in STEM careers. Sarah believed she had a professional obligation to participate in as many STEM fellowships and trainings as possible for the sake of her students' education. Sarah was committed to her personal mission by learning all she can about all the STEM careers she can. Sarah was concerned about doing her part with replenishing the pool of potential STEM professionals that she predicted the United States will need. Sarah's satisfaction would come if 100% of her students completed her science courses with at least a baseline knowledge of STEM.

Ann. In relation to responsibility perceptions, Ann believed creating a love of science and daily STEM discussions would increase students' interest in STEM careers. Ann believed in using her love of science to provide students with engaging, hands-on, and exciting STEM activities. Ann believed in addition to hands-on experiences, exposing students to the reality of STEM through discussions will provide students with a baseline knowledge of STEM careers. Ann wanted all her students to know that a STEM career was a possibility for each of them. Ann encouraged her students by making it her classes exciting with the addition of something new daily.

Billy. Concerning responsibility perceptions, Billy believed making science appealing for all students would encourage student interest in STEM careers. Billy used his personal experiences as a former student in a STEM major to encourage students to find a personal interest within science. Billy was adamant STEM was present in daily life and tried to instill in his students the importance of learning about STEM. Billy attempted to connect the world of STEM to STEM careers through his passion-robotics. Billy also used his personal relationships with STEM professionals to help students to visualize the possession of a STEM career as an attainable goal.

Audrey. In relation to responsibility perceptions, Audrey believed it her responsibility to facilitate the integration of STEM career-related lessons during science instruction by conversing with students about what they see in everyday life. Audrey indicated she used her childhood and her experiences in local venues as a prime example to show students the rate at which technology was advancing. Audrey also used her students' parents' occupations as a point of conversation to invoke students to create plans for their futures. Audrey demonstrated a passion about creating future STEM professionals that would help benefit communities. The demographic Audrey was most passionate about were her male athletes. Audrey indicated she wanted her students to think of themselves as more than just jocks. Audrey also believed students needed to understand how STEM affects them in order for students to spark an interest in STEM careers.

Thus, individual structural descriptions aligned with the theme of responsibility perceptions, because many teachers believed every student had the potential to be a STEM professional in careers students are exposed to and encouraged to pursue. Teachers believed it their responsibility to help students to decipher STEM careers from discussions, engaging, hands-on activities, and visits from STEM professionals.

Theme 2: Factors that affected rural elementary and middle-grade science teachers’ intention to integrate STEM career-related lessons during science instruction included: (a) state standards and assessments, (b) administrative influence, (c) time, (d) collaboration opportunities, (e) technology, (f) receptivity to additional training and support, and (g) availability of resources.

Ashley. In regards to perceptions of the impact of factors, Ashley believed state standards lacked a direct connection to STEM careers. Ashley also believed her administrators encouraged her to encourage students in STEM careers through the freedom she was given to conduct her STEM activities and discussions. Ashley also indicated she had outdated textbooks that emphasize non-STEM careers. Ashley felt that her intention to integrate STEM career-related lessons during science instruction was impacted by time. Ashley did not believe she had the time she wanted to integrate both STEM careers and teach the state mandated standards.

Betty. Concerning the perceptions of the impact of factors, Betty loved working with her students in the science lab and missed being a science coach. Betty believed state assessments, state standards, textbooks, lack of time, and lack of collaboration among other teachers severely impaired her fulfilling her full intentions with integrating

STEM career-related lessons during science instruction. Betty would love to do more STEM activities that would expose her students to STEM careers. Betty also wished she had more time to devote to science and that administrators valued science more. Betty was displeased with the amount of time and respect science as a subject received. Betty also wanted to collaborate more with her colleagues.

Felicia. With respect to the perceptions of factors, Felicia believed students were prepared for STEM career possibilities through field trips. Felicia wished her administration would become more aware of the importance of teaching students about STEM careers. Felicia believed if administrators were more knowledgeable of STEM the students would be permitted to attend more field trips to gain exposure to STEM careers. Felicia believed state standards and assessments were in alignment with students' preparation of STEM careers and mostly relied on Internet resources to make STEM careers relatable to her students. Felicia believed her intention to integrate STEM career-related lessons during science instruction would be more focused if she had access to more technology and had more knowledge of additional STEM careers.

Karen. Regarding the perceptions of factors, Karen believed her partnership with the 4-H extension program enabled her intention to integrate STEM career-related lessons during science instruction. Karen was neutral about the influence of state standards and assessments on her intentions. Karen believed due to her employment in a STEM magnet school, administrators expected teachers to be fully immersed in STEM. However, Karen believed her administration left the interpretation of the level of STEM activities students needed at teachers' discretion. Karen viewed technology as more of a hindrance with fulfilling her intention to integrate STEM career-related lessons during science instruction. Karen much preferred to use her science instructional time for hands-on experiments. Karen also indicated she had access to a textbook that provides student activities. Karen did not view her textbook as being STEM-oriented despite the textbook's claim. Karen indicated she was challenged in her ability to offer differentiated instruction to her special population of students.

Blanche. Concerning factor perceptions, Blanche appreciated having state standards and assessments to help her know how to plan, monitor progress, and set goals. Blanche did not mind having an outdated textbook since she uses a lot of technology and materials in her classroom. Blanche also liked that her administrators trusted in her abilities as a teacher. Blanche indicated she could benefit from having more resources and believed administrators would support her with securing classroom needs if funding was available. However, Blanche viewed science as being a secondary problem to reading and math. Blanche indicated that her students could possibly benefit from her incorporating more reading and math during her science instructional periods.

Thus, individual textual descriptions aligned with the theme of factors perceptions, because all teachers agreed on the bringing in of additional resources to integrate as many STEM careers into their science instruction as possible. Teachers named time, resources, technology, and collaboration as additional measures needed to fully integrate STEM career-related lessons during their science instructional periods. None of the teachers believed administrators prevented them from integrating STEM career-related lessons during science instruction. However, all the teachers indicated that their administrators could do more in terms of creating a stronger STEM presence within their schools. Teachers reported split feelings towards the effects of state standards and state assessment. Some teachers believed state standards and state assessments helped guide their STEM career intention; however, some teachers viewed the state standards and state assessments as time-consuming.

Theme 3: Rural elementary and middle-grades science teachers perceived intentions to integrate STEM career-related lessons during science instruction were a success when students were engaged, and students expressed interest in STEM careers.

Albert. Concerning perceptions of success, Albert considered his students' completed STEM career projects to be evidence of his success. Albert had earlier stated his contentment with the STEM career introductions the textbook he used in his science courses provided. Albert described how his students completed STEM career projects that align with his current textbook's units of study. Albert viewed these projects as a means for students to get more exposure to STEM careers. Albert also believed these STEM career projects informed students of future STEM career opportunities they would otherwise not be exposed to.

Betty. Related to success perceptions, Betty felt excitement when her students experienced success in getting an activity to work. Betty also felt it necessary for students to fully understand that science works through trial-and-error. Betty also experienced a sense of joy when seeing her students answer their own questions. Betty felt if students were questioning their failures, then they were thinking. Betty believed in time her students' failures would yield them great returns in terms of students being prepared for future STEM careers.

Audrey. In respect to perceptions of success, Audrey had an invested interest in the citizens her students become. Audrey demonstrated this interest by having authentic conversations with her students about their future. Audrey was thrilled when she heard students talking about entering into STEM careers after classroom discussions. Audrey felt a level of success when she heard students say they want to be math teachers. Audrey was committed to sharing whatever knowledge she had with students as she felt students needed support in building strong foundations for their futures.

Karen. Concerning success perceptions, Karen described students' engagement in STEM activities as a measure of her success. Karen credited the 4-H extension program with being able to implement her class' main activity. Karen was passionate in her description of this duck embryology project and portrayed it as a game changer in her science courses. Karen described this project as time-saving, and indicated this project supported her intention to create an exciting STEM environment in her science courses. Karen also expressed excitement when detailing the Hot Wheels STEM activity and the balloon car activities she indicated were a favorite of her male students. Karen was pleased with the amount of knowledge of students gained as a result of these hands-on experiences. Karen was also impressed with how creative her students could be.

Blanche. In regards to success perceptions, Blanche expressed her satisfaction when talking about how much ownership her students took in their learning. Blanche indicated she could tell the students were learning by the conversations and constructive arguments her students had among themselves as they completed experiments. Blanche prided herself in her ability to make her student self-sufficient learners. Blanche attributed her students' success on assessments to her teaching approach. Blanche believed her teaching approach also helped her students develop an appreciation for science and to further develop students' science interests.

Ashley. Related to success perceptions, Ashley described her students' excitement during STEM activity completions as her success. Ashley was also pleased to report her students' interest in building activities. Ashley credited the STEM-related building opportunities she provided with producing students who are now interested in engineering. Ashley disclosed she tried to foster students' expressed interests through discussions. Ashley indicated she also tried to incorporate as many of these type activities into her science instructional periods as she could.

Thus, the individual structural descriptions aligned with the theme of success perceptions, because rural elementary and middle-grades science teachers celebrated their students' success. In addition, teachers' responses indicated teachers cited their greatest success as students taking ownership of their learning.

Theme 4: Rural elementary and middle-grades science teachers believed the integration of STEM career-related lessons during science instruction to be important in opening students up to endless future opportunities, and in producing productive, contributing members of society.

Albert. In regards to the importance of STEM perceptions, Albert believed it important to recognize every student will not make it into the profession of choice. Albert opted to provide students with “a realistic view” of suitable STEM career options. Albert believed all students, regardless of their projected career path, needed exposure to all STEM careers. Albert had a personal mission to expose every student to as many STEM career choices as possible as a precautionary measure. Albert had the belief the only way many of the students he served would learn about STEM careers was through his science instructional periods.

Ashley. Concerning the importance of STEM perceptions, Ashley recognized the future need for high-salaried, STEM professionals. Ashley felt a sense of obligation to encourage her students to pursue STEM careers. Ashley believed her encouragement may yield students who could potentially secure such positions. Ashley believed her classroom discussions sufficed for this encouragement. Ashley believed her classroom discussions captivated the interest of students passionate about STEM and satisfied students’ curiosities that future opportunities STEM may have to offer to them.

Felicia. In respect to the importance of STEM perceptions, Felicia believed students could not give thought to careers they did not know about. Felicia believed in using her knowledge and things she has witnessed like television programs to motivate students to consider STEM careers. Felicia was passionate about making STEM relatable to her students. Felicia saw the importance of STEM all around her and tried to get her students to do the same. Felicia found solace in her abilities to connect as many concepts as possible to STEM careers.

Betty. Concerning the importance of STEM career perceptions, Betty believed students’ ages and minds stifled students from fully grasping everything she shared with them about STEM. However, Betty was not discouraged and was committed in her efforts to show students the correlations she believed existed between STEM concepts and STEM careers through research. Betty credited her school's career day and her daily conversations with students as exposing students to STEM career possibilities. Betty also believed strongly in exposing students to the transformations within science. Betty believed her teachings would become of more value to her students as they aged.

Sarah. Concerning the importance of STEM career perceptions, Sarah believed critical thinking was a valuable asset to teach students in preparation of future STEM career professions. Sarah also believed the students' possession of critical thinking skills would prepare them as future productive, contributing societal members. Sarah relied on the most current science related information to guide student inquiries and discussions. Sarah was concerned that the American culture did little to prepare students for potential STEM careers in terms of teaching discipline, work ethnics, and risk-taking. Sarah has also seen a fear of other cultures and blamed this fear on students', particularly African-Americans, lack of cultural awareness. Sarah wanted to ensure her students were able to compete for STEM jobs on an international level and had committed herself to lifelong learning to aid in her efforts.

Thus, the individual structural descriptions were in alignment with the theme of the importance of STEM career integration, because rural elementary and middle-grades science teachers believed early STEM career exposure would help students refine skills students needed for later success in future STEM careers. However, some teachers believed it best to provide students with the realities of STEM as a professions; others believed it suitable to provide students with an introductory knowledge of STEM careers.

Step 7: Composite Description

The composite description was constructed from the individual textual and structural descriptions and addressed all participants as a collective group. The composition description depicted the congealed essence of teacher participants' lived experiences. The composite description would be revealed in the results sections as it aligned to the pertinent research question of the study.

Discrepant Data

Discrepant data was data that offered a different perspective to the emerging major themes of the study. I discovered discrepant data in Theme 2. Theme 2 involved factors affecting rural elementary and middle grades science teachers' intentions to integrate STEM career-related lessons during the science instructional periods. I also found discrepant data in Theme 4. Theme 4 dealt with teachers' perceptions of the importance of STEM career integration.

In relation to Theme 2, one of the factors teacher participants described as affecting intentions to integrate STEM career-related lessons during science instruction was collaboration. The majority of teacher participants described collaboration as interactions between colleagues and community partners. However, one teacher participant felt that this collaboration needed to be extended to involve students in job shadowing. Audrey believed job shadowing would be beneficial to her students so the students could get a frontline glimpse into their community's available STEM professions. Another factor teacher participants described as affecting intentions to integrate STEM career-related lessons during science instructional periods was technology.

Beliefs about technology were split nearly equally. Teachers who taught in schools with 1:1 technology believed technology enabled their intentions to integrate STEM careers. On the other hand, teachers who were not in 1:1 technology having schools cited a need for additional technology to further support their intentions. However, one teacher offered an alternative viewpoint on technology. Although Felicia worked in a 1:1 technology setting, Felicia viewed technology as preventing her intention to integrate STEM career-related lessons during her science instructional periods. Felicia held the belief she was in a competition with technology for her students' attention. Felicia preferred hands-on experiments in lieu of monitoring her students as they completed their mandated time on her school district's mandated science websites.

In regards to Theme 4, Sarah added an additional feature to teacher participants' perceptions on the importance of STEM career-related lesson integration during the science instructional periods. Betty observed students possess a fear of other cultures. Sarah felt compelled to dismantle this fear within her students as Sarah indicated STEM professions were dominated by Africans, Indians, and Asians. Following this ideology, Betty believed it important to share this information with her students so they could "be on a level playing field with the internationals." Sarah expressed her sentiments as,

> I want our children to be on a level playing field with the internationals. I want them to know what's coming. I do a lot of reading. I do research about careers

that are up and coming and I just want the kids to be aware of that and not be afraid.

Evidence of Trustworthiness

I had several safety measures in place to address any challenges to the study findings that would have arose to ensure the trustworthiness of qualitative research. These security measures ensured reduced potential researcher bias, and that the study findings were objective, credible, and dependable. I also had safeguards in place to guarantee research was presented and interpreted in such a manner that the rich, thick descriptions of the study were contextualized (Merriam, 2016). This was so future researchers could have a clear picture of the extent to which the research could be transferred or applied to their situation (Merriam, 2016). I discuss the constructs of credibility, dependability, transferability, and conformability in the following paragraphs of this study.

Credibility

Credibility was the congruency of research findings with reality (Merriam, 2016). Member checks and adequate engagement in the data collection process were used to ensure the credibility of this study. For this study, I used member checks (Maxwell, 2014) by asking teacher participants to review the tentative findings of transcribed interviews to assess the credibility of the findings. I also used the strategy of adequate engagement (Merriam, 2016) by interviewing teacher participants until the data and emerging findings felt saturated. I determined that the data and emerging findings were yielding duplicate results with the tenth teacher participant. In addition, I used adequate engagement in that up to 45 minutes was spent with each teacher participant. The strategy of adequate engagement in data collection was also used by purposefully seeking responses during the interview phase of data collection that challenged the patterns that emerged. Data was analyzed as discrepancies and reported as discrepant data in a later section.

Dependability

Merriam (2016) defined dependability in qualitative research as yielding study findings consistent with the presented data. Strategies that were recommended by Merriam (2016) I embraced for this research study were triangulation and an audit trail. I used triangulation by interviewing participants from different regions within one state in the southeastern United States, who taught different grade levels, and from different educational settings. I also used the strategy of an audit trail to ensure the dependability of this research. This audit trail, according to Merriam, enabled researchers to understand how results were attained so they can replicate the study. For this study, the audit trail was a research journal that described the data collection and analysis processes. This audit trail contained thoughts, questions, ideas, and any issues that arose during the data collection phase. It also contained a running record of how data was interpreted and analyzed.

Transferability

Merriam (2016) defined transferability as the ability of the research findings to be applied to other settings. To enhance the probability of transferability of this research to other settings, I used the strategy of rich, thick description. This rich, thick description was given through use of Merriam's (2016) suggestion. Rich, thick descriptions included a detailed description of the study's setting and participants (Merriam, 2016). Also, a detailed description of the study's findings with quotes to ensure adequate evidence were presented (Merriam, 2016). Such quotes were obtained from the interview and the reflective journal entries.

Confirmability

Merriam (2016) recommended qualitative researchers consider the use of the strategy of reflexivity to enhance the confirmability of research. To understand reflexivity, we must first understand its definition. Merriam (2016) defined reflexivity as the researcher's position about assumptions and biases that may affect the results of the study. The strategy of reflexivity were used by reflecting on biases, dispositions, and assumptions about the research being conducted, as recommended by Merriam. A description of the disclosure process follows.

This disclosure, according to Merriam, helped readers to gain a sense of the integrity of the researcher and to get an understanding of how the researcher interpreted the data collected. Therefore, an audit trail to provide readers with a detailed accounting of the research process was used. As recommended by Merriam, this audit trail contained thoughts, questions, ideas, and any issues that arose during the data collection phase. It also contained a running record of how data collected was analyzed and collected to give readers a better understanding of how the categories and themes were created in relation to the findings of this study.

Results

The results were analyzed in relation to the research question: "What are intentions of rural elementary and middle-grade science teachers as it pertains to integrating STEM career-related lessons during science instruction?" I also analyzed the results in conjunction with the specific subquestions of this study. The specific subquestions of this study involved teachers' beliefs about integrating STEM career-related lessons during science instruction in the elementary and middle-grades, perception of influence from subjective norms, perceptions of resources impacting participation in STEM career integration, and perception of capability in STEM career integration. I disseminate the results of the research questions and subquestions in the following paragraphs.

Intentions of STEM Career Integration

The central research question sought to answer, "What are the intentions of rural elementary and middle-grade science teachers as it pertains to integrating STEM career-related lessons during science instruction?" All 10 teacher participants intended to integrate STEM career-related lessons during science instruction. Evidence to support this claim was found within Themes 1 and 3. Theme 1 also provided answers to subquestion 1, "What do rural elementary and middle-grades science teachers believe about integrating STEM career-related lessons during instruction in the elementary and middle-grades?" In addition, Theme 1 contained responses to interview questions: (IQ1) "How do you describe your intentions to integrate STEM career-related lessons into the science courses you teach?", (IQ2) "What role do your intentions play in the frequency with which you integrate STEM career-related lessons during science instruction?", (RJQ1) "What successes and challenges have you had with fulfilling your intentions to integrate STEM career-related lessons into the science courses you teach?" and contained partial responses for (IQ3) "What are your beliefs about the integration of information about STEM careers into science courses?", (IQ4) "What do you believe about the teacher's responsibility to encourage students to become more interested in STEM careers?", and (RJQ2) "Why do you, or do not, believe you should encourage students in the grade level you teach to explore science careers?"

In Theme 1, rural elementary and middle-grade science teachers perceived it their responsibility to facilitate the integration of STEM career-related lessons during science instruction through (a) student-centered, STEM activities, (b) the regular engagement of students in STEM discussions, (c) the bringing in of external sources, (d) creating a love of science, (e) presenting STEM careers as an attainable goal, and (f) making science appealing to all students. Interview Question 1 asked, "How do you describe your intentions to integrate STEM career-related lessons into the science courses you teach?" Interview data yielded the following answers in Theme 1 in regards to Interview Question 1. Teacher participants indicated they intended to integrate STEM career-related lessons during science instruction by means of (a) through student-centered, STEM activities, (b) the regular engagement of students in STEM discussions, and (c) the bringing in of external sources. Teacher participants' responses to Interview Question 3 yielded the addition of (d) creating a love of science, and (e) presenting STEM careers as an attainable goal.

Interview Question 4 reiterated student-centered, STEM activities and added (f) making science appealing to all students. One teacher participant indicated he used robotics to introduce engineering to his elementary grade students. Billy stated: "First, in my class we do a lot of robotics dealing with engineering." In regards to discussions, teachers used discussions to help students make real world connections between the science concept of study and STEM careers. Ashley added: "After completing a STEM activity, we discuss how it is relevant in real life concerning skills, jobs, and careers."

Numerous teachers also described the bringing in of external sources to aid their intention to integrate STEM career-related lessons during science instruction. For instance, Sarah relied on her "partnerships" with companies like Boeing and the Savannah River Site to assist her with fulfilling her intentions within her science courses. While, Billy and Karen appreciated the assistance they received from their local 4-H extension programs. Billy indicated, "They [4-H] actually were doing a unit on adaptations with my students. ….and the next week they came back and did something on electricity. Karen indicated, "I was there along with 4-H to do things like the ducks and other things like that."

In regards to creating a love of science, Ann expressed her response in Interview Question 3, "I believe that when children are taught the basics of STEM and I show the students my love of the field through hands-on activities, the students will develop a love for science too." Ann was also one of the many teachers who believed in presenting STEM careers as an attainable goal. In response to Reflective Journal Question 2, Ann articulated, "they [students] can have a career just like those individuals they read about and be happy going to work every day while making a decent salary." Numerous teachers also described their intention to integrate STEM career-related lessons during science instruction by making science appealing to all students. In regards to Interview Question 4, Albert believed making STEM more appealing would assist with alleviating negative stereotypes about STEM. According to Albert, "STEM can be portrayed as a little bit abstract or it probably comes off as being difficult or that the students have to be smart to be involved in. When, it's like basic little stuff as I said like robotics."

Interview Question 2 asked, "What role do your intentions play in the frequency with which you integrate STEM career-related lessons during science instruction?" Teacher participants' responses to the above-referenced interview and reflective journal questions indicated the frequency with which teachers integrated STEM careers during science instruction to be regularly. Evidence in support of this assertion could be seen in key phrases within the interview transcripts and reflective journal responses such as "on a daily basis", "weekly I incorporate STEM projects", "every unit", "at least three days a week", and "at least once a week maybe twice."

In Theme 3, rural elementary and middle-grades science teachers perceived intentions to integrate STEM career-related lessons during science instruction were a success when students were engaged, and students expressed interest in STEM careers. Theme 3 provided a partial response to Reflective Journal Question 1, "What successes and challenges have you had with fulfilling your intentions to integrate STEM career-related lessons into the science courses you teach?" Several teacher participants' responses indicated students' completion of STEM activities were a success. Rural elementary and middle-grades science teachers' responses indicated students were more engaged when students were allowed to engage in self-discovery, and supported in reaching a level of self-efficacy. One participant, Betty, reacted, "That's a victory." Betty's statement was in response to her students' using trial-and-error to complete a STEM activity.

Other studied rural elementary and middle-grades science teachers' also celebrated their students' success. Blanche, for instance, stated, "The reward is them knowing the information, giving it back to me without me, most times, without me having to even ask." In addition, teachers' responses indicated teachers cited their students' greatest success as students taking ownership of their learning. For example, Ashley described her students' interest in building activities. Ashley stated, "This has inspired a lot of discussion about engineering and many of my students have stated that they would like to be engineers when they grow up."

Beliefs about STEM Career Integration

Subquestion 1 asked, "What do rural elementary and middle-grades science teachers believe about integrating STEM career-related lessons during instruction in the elementary and middle-grades?" All 10 teacher participants believed STEM career-related lesson integration was important and teachers were responsible for integrating STEM career-related lessons into their science courses. Evidence in support of these assertions was found in Theme 4. Theme 4 also provided answers to the following interview questions: (IQ3) "What are your beliefs about the integration of information about STEM careers into science courses?", (IQ4) "What do you believe about the teacher's responsibility to encourage students to become more interested in STEM careers?", and (RJQ2) "Why do you, or do not, believe you should encourage students in the grade level you teach to explore science careers?"

In Theme 4, rural elementary and middle-grades science teachers believed the integration of STEM career-related lessons during science instruction to be important in opening students up to endless future opportunities, and in producing productive, contributing members of society. In regards to opening students up to endless future opportunities, teacher participants mentioned STEM careers such as doctors, nurses, pediatricians, power plant workers, engineers, construction workers, biologists, zoologists, scientists, and mathematicians. However, some teachers believed it best to provide students with the realities of STEM as a professions. For instance, Albert believed it important to reiterate not all students would not be "doctors, nurses, pediatricians, and they expect to be." Sarah had this to say, "I don't care if you are not a scientist, you're still going to have to deal with science, technology, engineering, and mathematics in some kind of way."

Others believed it suitable to provide students with an introductory knowledge of STEM careers. Concerning producing productive, contributing members of society, teacher participants believed STEM was going to be a part of many future jobs and that students had to have at least a baseline knowledge of STEM. For instance, it was important to Sarah "that every child has to at least a baseline knowledge of engineering in their science curriculum." Rural elementary and middle-grades science teachers also believed early STEM career exposure would help students refine skills students needed for later success in future STEM careers. Major skills teacher participants named as being in need of refinement included inquiry, reading, critical thinking, problem-solving, and mathematics.

Perceptions of Subjective Norms Influence

Subquestion 2 asked, “How do rural elementary and middle-grade science teachers describe influence from subjective norms in integrating STEM career-related lessons during science instruction to elementary and middle-grade students?” None of the teachers believed administrators prevented them from integrating STEM career-related lessons during science instruction. However, all the teachers indicated their administrators could do more in terms of creating a stronger STEM presence within their schools. Teachers reported split feelings towards the effects of state standards and state assessment. Some teachers believed state standards and state assessments helped guide their STEM career intention; however, some teachers viewed the state standards and state assessments as time-consuming. Evidence in support of these claims was found in Theme 2. Theme 2 also provided answers to the following interview questions: (IQ5) “How do you believe the emphasis on state standards and state assessments impacts your preparation of students for careers in science?” And (IQ6) “What influence would you describe your administration as having on your integration of STEM career-related lessons into the science courses you teach?”

In Theme 2, factors that affected rural elementary and middle-grade science teachers’ intention to integrate STEM career-related lessons during science instruction included: (a) state standards and assessments, (b) administrative influence, (c) time, (d) collaboration opportunities, (e) technology, (f) receptivity to additional training and support, and (g) availability of resources. However, to make the case for this section only subsections a and b were examined in the following paragraphs. In regards to IQ5, six of the ten teacher participants believed standards and state assessments were actually aligned with preparing students for careers in careers in science. However, these same teachers believed standards must be interpreted, applied, and taught properly for this to occur. On the other end of the spectrum were teachers who believed the number of standards teachers were expected to teach and standardized assessments depleted time that could be spent properly preparing students for STEM careers.

In regards to IQ6, the majority of the teachers believed administrators encouraged them to integrate STEM activities into their lessons, provide opportunities for teachers to engage in STEM training, and foster a STEM culture. In the same breath, however, teachers like Sarah reported,

> The administration rarely says anything. They don't really put their money where their mouth is when it comes to kids or things that really align with what people in STEM are doing. I think they embrace it. I think they welcome it, but it has to be on someone else's dime. Like if you can get the money as a teacher that's fine. I don't think they shy away from it or anything like that. But they put too much responsibility on the teacher, I believe. But the overarching permissions are in place.

Much to the same sentiment, Felicia doubted her administration knew about STEM or STEM careers. Karen believed her administration left the interpretation of the level of STEM activities the students needed at teachers' discretion. Betty believed,

> So administrators, whether it's district leadership, or whether it's school leadership, they set that wheel in motion to what they think is important. If a principal was a science teacher, if that was his or her love you would see that within the school. If math or ELA or whatever if that was their love, you would see more of that. So, it depends on what the push for the district is or what the push is school wide is. That's what you will see more of. You will see more focus in that department.

Perceptions of Perceived Behavioral Controls

Subquestion 3 investigated, "What factors do rural elementary and middle-grade science teachers describe as impacting their participation in integrating STEM career-related lessons during science instruction to elementary and middle-grade students?" Factors that rural elementary and middle-grade science teachers' described as impacting their participation in integrating STEM career-related lessons during science instruction included: (a) state standards and assessments, (b) administrative influence, (c) time, (d) collaboration opportunities, (e) technology, (f) receptivity to additional training and support, and (g) availability of resources. Evidence in support of these claims were found in Theme 2. Theme 2 also provided answers to the following interview question and reflective journal question: (IQ7) "What information does the textbook and instructional materials you use include about science careers?" And (RJQ3) "What specific factors and/or needed resources do you see as enabling or preventing your intention to integrate STEM career-related lessons during science instruction?"

In regards to IQ7, teacher participants shared differing experiences with the science textbook. One experience teacher participants did seem to agree on was the textbook alone was not adequate for preparing students for science careers. Teachers indicated the newer textbooks they used included sections about science careers. Ashley did not believe the careers in the textbook were "necessarily STEM careers." Karen shared similar thoughts.

Karen indicated, "They call them STEM checks, but you actually look at them, they're really not STEM activities." From the responses, it seemed Albert, Ann, Sarah, and Billy would disagree. All four teacher participants believed the textbook did due diligence to the integration of science careers According to Albert, "So, the Pearson textbook that we use pretty much integrates a lot of like STEM and science careers." Ann found, "The textbook highlights areas of careers in almost every section."

Audrey also saw the correlation between science careers and the textbook when "talking about the weather and [how] it pulls in with the different careers." Sarah had a similar experience with the science textbook she used in her science courses. Sarah said, "Well, I know our text by McGraw-Hill is topped with STEM all through it." Billy, however, only agreed to a certain extent. Billy believed the science textbook to be a primary source for introducing STEM careers; however, teachers needed to supplement the science textbook with additional resources. One resource Betty believed teachers should use as source of information was themselves. Felicia believed real-world discussions to be among the best practices for supplementing the little STEM information she did see in her science textbook.

Theme 2 provided evidence in support of answering RJQ3. In Theme 2, factors that affected rural elementary and middle-grade science teachers' intention to integrate STEM career-related lessons during science instruction included: (a) state standards and assessments, (b) administrative influence, (c) time, (d) collaboration opportunities, (e) technology, (f) receptivity to additional training and support, and (g) availability of resources. However, to make the case for this section only subsections c, d, e, and g were examined in the following paragraphs. In respect to time, it was named by teacher participants as preventing the integration of STEM career-related lessons during science instruction. According to Billy, "Anytime you are teaching any type of STEM activity, subject or concept, you don't have as much time as you have with your core subjects such as math or ELA."

Lack of collaboration was also named as preventing STEM career integration. Teacher participants expressed interest in collaborating with other science teachers, teachers of other subject areas, and business partners. In regards to technology, teacher participants described technology as enabling their intention to integrate STEM career-related lessons during science instruction. However, teachers who taught in schools where 1:1 technology was unavailable, cited a lack of technology as a prevention to integrating STEM career-related lessons. The exception, however, was a teacher from a 1:1 technology having school who believed, "computers take these experiences away from students." In relationship to the availability of resources, teachers indicated a need for updated textbooks, funding, and materials to use for activities.

Beliefs about Capability

Subquestion 4 looked for answer to: "How do rural elementary and middle-grade science teachers perceive their capability to integrate STEM career-related lessons during science instruction to elementary and middle-grade students?" All of the teacher participants articulated being capable of integrating information about STEM careers into the science courses they taught. Theme 2 provided evidence in support of answering Interview Question 8. In Theme 2, factors that affected rural elementary and middle-grade science teachers' intention to integrate STEM career-related lessons during science instruction included: (a) state standards and assessments, (b) administrative influence, (c) time, (d) collaboration opportunities, (e) technology, (f) receptivity to additional training and support, and (g) availability of resources. However, to make the case for this section only subsection f was examined in the following paragraphs.

Interview question 8 asked, "How do you describe your capability to integrate information about STEM careers into the science courses you teach?" Many of the teacher participants described this capability as being able to at least discuss some aspect of STEM careers with students. Several teacher participants felt their capability to integrate information about STEM careers into the science courses they taught was enhanced through professional developments and technology. Although capable of integrating information about STEM careers into the science courses they taught, several of the teacher participants felt they would be better capable if they were provided with additional administrative support, STEM career training, a decrease in other teacher responsibilities, and had more funding. Billy admitted as a new teacher he had seen a shift in his confidence over the span of his teaching career. Billy said,

> To be honest with you, when I first started teaching I actually was afraid of science. As the years went along, I have definitely become very, very, very, very confident. I feel good about my capability to teach science. Especially since now, I understand in science you have to learn by doing and not just by reading and things of that nature. So, I would say I have grown a lot in my capability.

The learning Billy attributed to his increase in capability level was one other teacher participants had experienced as well.

Additional teachers also described the impact professional development, personal research, and continued learning had on their success. Sarah noted, “I work with scientists every year of varying disciplines.” For teachers who had a strong intent to integrate STEM career-related lessons during science instruction, teachers would seek out additional means to enhance their levels of capability. In addition, teachers were receptive to additional training and support. For instance, one teacher expressed his appreciation to his administration for providing him with professional development experiences. Another teacher credited her work with summer fellowships as preparing her to integrate STEM career-related lessons during her science instructional periods. Yet another interviewed teacher wanted additional knowledge on careers that coincided with STEM and the standards she taught.

Summary

In Chapter 4, I presented the results of the study. In this chapter, I presented the study's setting, demographics, and means of data collection. In the data analysis section, I described the seven steps of the modified van Kaam phenomenological data analysis plan. In addition, I presented discrepant data which offered a different perspective to the emerging themes. I also discussed credibility, transferability, dependability, and conformity as evidence of the trustworthiness of this qualitative dissertation. The chapter concluded with the results of the key findings.

Chapter 5 discusses the findings, conclusions, and recommendations for future researchers. Also included in Chapter 5 is a summary of the findings, and I interpret these findings in alignment with Chapter 2's literature review and Ajzen's theory of planned behavior. I close this chapter with a discussion on the limitations of the study, recommendations for further study, and discuss how this study on the rural elementary and middle-grades teachers' intention to integrate STEM career-related lessons during science instruction contributes to positive social change.

Chapter 5: Discussion, Conclusions, and Recommendations

Introduction

The purpose of this qualitative study was to understand how intentions impact rural elementary and middle-grade teachers' integration of STEM career-related lessons into science instruction. I achieved this purpose by using the transcendental phenomenological research to explore the conscious experiences of the phenomenon of rural elementary and middle-grade teachers who intended to integrate STEM career-related lessons during science instructional periods in one state in the southeastern United States. I conducted this study because there was limited research regarding how intentions may influence rural elementary and middle-grade teachers' integration of STEM career-related lessons. Four main findings emerged from my analysis of the data. The first main finding was that rural elementary and middle-grade science teachers perceived that it was their responsibility to facilitate STEM career-related lessons during science instruction through student-centered STEM activities, engaging students in STEM discussions, including external sources, creating a love of science, presenting STEM careers as an attainable goal, and making science appealing to all students. Teachers also believed it was their responsibility to prepare students for the ever-changing global society and students' future self-sustainability.

The second major finding was that several factors affected rural elementary and middle-grade science teachers' intention to integrate STEM career-related lessons during science instruction. These included (a) state standards and assessments, (b) administrative influence, (c) time, (d) collaboration opportunities, (e) technology, (f) receptivity to additional training and support, and (g) availability of resources. Teachers also believed the focus on science has declined over the years, and much is left up to teacher interpretation. In addition, teachers' responses indicated a possible need to expand teachers' STEM career knowledge and to integrate additional subjects into STEM. Another key finding was that rural elementary and middle-grades science teachers perceived intended plans to integrate STEM career-related lessons during science instruction were a success when students were engaged, and students expressed interest in STEM careers. In addition, teachers' responses indicated students were more engaged when they were allowed to engage in self-discovery, supported in reaching a level of self-efficacy, and self-motivated. The fourth main finding was that rural elementary and middle-grades science teachers believed the integration of STEM career-related lessons during science instruction to be important in opening students up to endless future opportunities, and in producing productive, contributing members of society. In addition, teachers' responses indicated students may need more exposure to STEM career professionals, opportunities to engage in critical thinking, and understanding of failure as part of the inquiry process.

Interpretation of the Findings

I interpreted the findings of this study in conjunction with the literature I discussed in Chapter 2 and Ajzen's theory of planned behavior, which served as the theoretical framework of this study. The major constructs in the theory of planned behavior are intentions, beliefs, attitude, subjective norms, and perceived behavioral control.

Intentions of STEM Career Integration

The results of the study found teachers intended to integrate STEM career-related lessons during science instruction. In the context of the study, teachers' intention to integrate STEM career-related lessons during science instruction would be what Husserl (1931) coined as the noema. According to Thomson and Gregory (2013), teachers' beliefs profoundly inform their pedagogical practices. Ajzen (1988) posited that beliefs are linked to intentions. Intentions are the result of one's perceived capability to perform the behavior (Sandberg et al., 2016). In the context of this study, Ajzen's theory (1988, 1991) would hold teachers' intentions directed their behavior for integrating STEM career-related lessons into science instruction.

Other researchers (Dailay, 2013; Opperman, 2015; Owens, 2014; Turner, 2013; Webb, 2015) suggested that teachers' knowledge or attitude about STEM could influence their intentions. For example, Lin and Williams (2015) surveyed 139 Taiwanese pre-service teachers to explore knowledge, values, attitudes, subjective norms, and perceived behavioral control towards intent to engage in STEM education. They found that higher reported levels of perceived behavioral control and subjective norms led to stronger STEM integrating intent. Indirectly, they found increased knowledge and positive attitude correlated with higher subjective norms and perceived behavioral control. Though, indirectly, Lin and Williams (2015) found increased knowledge and positive attitude also linked to stronger STEM integrating intent.

STEM integration, according to McDonald (2016), includes the use of real-world connections to examine authentic problems using active integrating and learning strategies. Rural elementary and middle-grade science teachers indicated facilitation of the integration of STEM career-related lessons during science instruction through student-centered STEM activities, engaging students in STEM discussions, including external sources, creating a love of science, presenting STEM careers as an attainable goal, and making science appealing to all students. In the context of the study, the self-evidence teacher participants named as proof of their facilitation of the integration of STEM career-related lessons would be the noesis (Hussel, 1931). My findings aligned with those of other researchers in the literature I reviewed. In a case study, Banks (2013) investigated STEM-integrated instructional practice and teachers’ self-efficacy of five North Carolina National Board certified teachers. The results of Banks’ (2013) study revealed teachers’ use of hands-on, project-based learning, opportunities for the students to collaborate, and invitation of guest speakers to establish the career-relevancy of lessons taught.

Gomez and Albrecht (2014) examined research conducted by the National Academies, the National Research Council, and the National Science Foundation and found teachers' translation of lessons learned to real-world applications and career-oriented examples captured and retained the interest of students. Furthermore, the researchers recommended the promotion of STEM careers to include inspirational and optimistic prospects (Gomez & Albrecht, 2014). McNally (2012) added that any approach taken should present STEM as an essential tool students need for the future career goals. In the literature review, I found that researchers contended that an integrated approach should be taken starting in the middle grades. However, other researchers like

Archer et al. (2012) suggested an approach to STEM integration beginning in the early to middle elementary grades. Archer et al.'s (2012) suggestion was echoed in a response made by a participant interviewed in the study. According to this participant, "Kids need to be Pre-K playing around with STEM concepts and projects."

Additionally, educators should make an effort to illustrate that any student can make a difference in the world (Archer et al., 2012). According to Stohlmann, Moore, and Roehrig (2012), "Integrated STEM education could motivate students to careers in STEM fields" (p. 32). Integration would further help STEM fields recruit adequate diversified student populations to STEM careers (Crippen et al., 2015; White, 2014). I found that rural elementary and middle-grades science teachers perceived intended plans to integrate STEM career-related lessons during science instruction were a success when students were engaged, leading students to express interest in STEM careers. In addition, teachers' responses indicated that their students' greatest successes came when they took ownership of their learning. In the context of the study, the engagement of students and students taking ownership of their learning would represent Husserl's (1931) concept of noesis. I found that teachers' intentions were rooted in an attitude of responsibility.

Beliefs About STEM Career Integration

Attitudes are developed from salient beliefs an individual has towards an object, and they influence behaviors through intentions (Ajzen & Fishbein, 1980; Conner & Armitage, 1998; Doll & Ajzen, 1992; Fishbein & Ajzen, 1975). All 10 teacher participants believed STEM career-related lesson integration was important and that they were responsible for integrating STEM career-related lessons into their science courses.

This aligned with findings in the literature I reviewed. For instance, Madden, Beyers, and O'Brien (2016) reported 100% of the 73 pre-service and early career elementary teachers studied reported positive attitudes towards STEM integration at the elementary level. In regard to teachers' attitudes of responsibility, Carrico, Murzi, and Matusovich (2016) used a mixed method approach to explore and compare rural Virginia and Tennessee students' and educators' perceptions of STEM career decision influencers.

Carrico et al. (2016) argued that teachers were responsible for integrating STEM career-related lessons into their instruction. Vaughn and Saul (2013) examined the reported visions and challenges of fulfilling these visions of 10 rural teachers in Idaho attending a part-time master's degree program. In this phenomenological study, Vaughn and Saul (2013) reported that teachers felt a sense of responsibility to the students and close-knit communities where they were employed, which compelled them to at least attempt their visions. In this study, many of the teachers' responses to the interview questions were tied to their assessment of their communities as being agrarian and/or manufactory based. Rural elementary and middle-grades science teachers believed the integration of STEM career-related lessons during science instruction to be important in opening students up to endless future opportunities, and in producing productive, contributing members of society. Rural elementary and middle-grades science teachers also believed early STEM career exposure would help students refine skills students needed for later success in future STEM careers.

Major skills teacher participants in my study named as needing refinement included inquiry, reading, critical thinking, problem-solving, and mathematics. Their responses aligned with findings in previous studies. Kahn (2015) used three middle-grade teachers from Texas, two from North Carolina, one from Illinois, one from Michigan, and one from California to examine strategies teachers used to integrate STEM. Also, studied were integrated STEM standards in a courses' scope and sequence, assessment practices, benefits, and posed challenges. Kahn's (2015) participants indicated a need for students to have more opportunities to demonstrate their knowledge-base. In regard to benefits of STEM integration, teachers noted problem-solving, critical thinking, and application to the real-world.

Perceptions of Subjective Norms Influence

According to Lin and Williams (2015), subjective norms refer to an individual's perceived social pressure to perform a particular behavior. Some examples of subjective norms that appeared in current literature were pressures from administrators, community members, district leaders, and science department heads. However, in the context of this study, teacher participants named only administrators, state standards, and state assessments as influencing subjective norms. None of the teacher participants believed administrators prevented them from integrating STEM career-related lessons during science instruction. This result differed from the finding of previous researchers.

Vaughn and Saul (2012) found that administrators discouraged STEM integration with studied participants. However, all of my teacher participants indicated their administrators could do more in terms of creating a stronger STEM presence within their schools. My findings aligned with those of other researchers in the literature I reviewed. For instance, Wu-Rorrer's (2015) data analysis showed strong administrative support was needed to recruit and engage future STEM students. Goodnough, Pelech, and Stordy (2014) conducted a qualitative study on primary and elementary teachers' perceptions of an effective STEM professional development.

In this study, teachers cited administrative support as a key component (Goodnough, Pelech, & Stordy, 2014). In Galosy and Gillespie's (2013) mixed methods study of novice mathematics and science teachers' learning experiences in the Knowles Science Foundation 5 year integrating fellowship, the researchers evaluated the work samples, meeting agendas, and internal evaluations of 162 fellows and 45 senior fellows. They also administered a survey to these same participants. Findings showed that the growth and sustainability of teachers hinged on support teachers received in creating a content-rich professional community, pedagogical inquiry, and classroom leadership. Support in these three areas was found to strengthen the fellows' perceptions of themselves as capable professionals, and bolstered their commitment to integrating science and mathematics in a complex and challenging way.

Teachers in my study reported split feelings regarding the effects of state standards and state assessment. Some teachers believed state standards and state assessments helped guide their STEM career-related lesson integration intention; however, some teachers viewed the state standards and state assessments as time-consuming. This finding aligned with those in the literature. Kahn (2015) examined the benefits and posed challenges of strategies teachers used to integrate STEM standards in a course's scope, sequence, and assessment practices. Kahn (2015) found that freedom from standards could help teachers more effectively integrate STEM. Also, Kahn (2015) indicated that half of the teacher participants interviewed contended that standardized state tests inadequately assessed STEM skills, processes, and practices.

Perceptions of Perceived Behavioral Controls

Perceived behavioral control refers to the "perceived ease or difficulty of performing the behavior and is assumed to reflect past experiences as well as anticipated impediments and obstacles" (Ajzen, 1988, p. 132). According to the theoretical proposition of perceived behavioral control, beliefs regarding whether one has the needed resources and opportunities are judged against the capability to perform the behavior as proclaimed by Ajzen. According to Armitage (2015), capability referred to an individual's perceived ability to perform a particular task. All of the teacher participants articulated being capable of integrating information about STEM careers into the science courses they taught. This result contradicted one source used in the literature review.

Owens's (2014) descriptive case study of 20 participants used Bandura's (2001) social cognitive theory to investigate how the actions, thoughts, and feelings a person could control were dependent on perceptions of capability. Evidence of Owens's (2014) study of capability as a contingency was manifested in the study's dissemination of results of participants' answers to questions regarding elementary teachers understanding of elementary level STEM education, self-evaluation of capability to teach STEM and its effect on STEM integration in their classrooms, descriptions of STEM education training and preparation, and perceived obstacles. In an analysis of result findings, the research disclosed 75% of respondents were uncomfortable integrating STEM citing feelings of inadequate preparedness. Also, teachers were unsure of how STEM integration should take place in grades K-5. However, additional sources within the literature review supported the results of my study.

A review of the literature found Azjen's (1988, 1991) construct of perceived behavioral control investigated through Bandura's (1997) self-efficacy theory. For example, Prentiss Bennett (2016) investigated 137 elementary teachers' self-efficacy to teach integrated STEM. As cited by Prentiss Bennett (2016): "self-efficacy referred to 'beliefs in one's capabilities to organize and execute the courses of actions required to produce given attainments'" (as cited in Bandura, 1997, p. 3). Results of the quantitative aspect of this mixed-methods study reported high levels of self-efficacy. Miller (2015) also examined teacher's self-efficacy. Miller's (2015) mixed methods study reviewed 15 upper elementary faculty and 361 students among three schools in south-central Pennsylvania in search of an understanding of influences in upper elementary students' attitudes towards STEM subjects and careers. Found was teachers' efficacy had a substantial impact on teachers' instructional practices as well as directly correlating to student achievement as described by Miller.

Factors that rural elementary and middle-grade science teachers' described as impacting their participation in integrating STEM career-related lessons during science instruction included: (a) state standards and assessments, (b) administrative influence, (c) time, (d) collaboration opportunities, (e) technology, (f) receptivity to additional training and support, and (g) availability of resources. In respect to time, it was named by teacher participants as preventing the integration of STEM career-related lessons during science instruction. A source within the literature review was deemed to offer support for this result. Goodnough, Pelech, and Stordy (2014) conducted a qualitative study on primary and elementary teachers' perceptions of an effective STEM professional development. In Goodnough et al.'s study (2014), the need for additional time was one key component cited.

Teacher participants also credited lack of collaboration as preventing STEM career integration. Teacher participants expressed interest in collaborating with other science teachers, teachers of other subject areas, and business partners. Evidence in support of this result was found within the literature review. Martin's (2016) case study investigated 14 STEM-focused elementary school teachers' practices deemed relevant to STEM integrating and learning. In Martin's (2016) case study, teachers also stated the need for collaboration and community partnerships.

In Lehman, Kim, and Harris's (2014) mixed methods study examined were participants' perceptions of a STEM education partnership project in which university faculty members and elementary school teachers collaborated to develop and implement engineering design-based materials. Found were collaborations among Community of Practice participants were crucial to the success of school-based STEM education reform initiatives. Avery (2013) noted rural elementary and middle-grade teachers needed additional support with providing scaffolding real-world connected content and providing students with concrete experiences. Clark, Majumdar, Bhattachajee, and Hanks (2015) used a mixed methods approach and studied 28 Louisiana middle-grade teachers who completed a 2 phase summer program. This summer program consisted of collaborations with university faculty, partnerships with scientists as the participants collected weather data during a field experience and learned how to establish weather stations at their home schools.

The purpose of this program was to equip teachers with the support and training to empower teachers to obtain a more in-depth understanding and ownership of the environment at the regional and local levels. A strength of this study was it provided a hands-on, engaging, real-world experience students from agrarian backgrounds could associate with their local communities. Also, it helped to surpass the differences in socioeconomic status among students as it required no use of technology or other resources the students may or may not have at their disposal. In regards to technology, teacher participants described technology as enabling their intention to integrate STEM career-related lessons during science instruction. However, teachers who taught in schools where 1:1 technology was unavailable, cited a lack of technology as a prevention to integrating STEM career-related lessons. The exception, however, was a teacher from a 1:1 technology having school who believed, “computers take these experiences away from students.”

Teachers also believed the focus on science had declined over the years, and much is left up to teacher interpretation. In addition, teachers’ responses indicated a possible need to expand teachers’ STEM career knowledge and to integrate additional subjects into STEM. Also, cited was a disclosure of studied teachers’ lack of STEM career knowledge (Reiss and Mujtaba, 2017). Carrico et al. (2016) reported STEM career knowledge was lacking among teachers. In relationship to the availability of resources, teachers indicated a need for updated textbooks, funding, and materials to use for activities. These needs were supported by examples seen in the literature review. Thompson and Nietfield (2016) conducted a mixed-methods study involving 132 elementary teachers from 9 North Carolina public schools to investigate the translation of teachers' belief systems and educators and science content knowledge into the teachers' science classroom practices. A significant finding of the studied teachers was a lack of resources and professional development for adequate STEM integration (Thompson & Nietfield, 2016). Results of Prentiss Bennett (2016) mixed-methods study revealed the reporting of a need for more curriculum support, resources, materials, and STEM-related trainings and professional developments.

Limitations of the Study

There were several limitations to this study. The first limitation dealt with the transcendental phenomenological design. The transcendental phenomenological design involved a study of an individual's experience through the individual's consciousness, which for this study were rural elementary and middle-grade science teachers' intentions in one state in the southeastern United States as expressed through experiences with STEM career-related lesson integration. Therefore, transferability may be restricted to similar populations of teachers. However, I minimized this limitation by providing rich, thick descriptions of the conscious experiences of these teachers and findings so transferability might apply to rural elementary and middle-grade science teachers in other rural locations.

The second limitation was related to subject area. My specific subject area of focus for this study was science. However, three of the ten teacher participants interviewed also taught additional subject areas. Two participants taught mathematics and science, while one teacher participant was a self-contained teacher. This may have had a minor impact on these teacher participants' responses to the interview questions and the reflective journal questions. However, I minimized this impact by asking specific questions about science careers.

The third limitation was sample size. I interviewed 10 teacher participants who met the specific inclusion criteria for this study. The 10 participants in this study included two males and eight females, which is not gender-balanced. Four of the ten participants were Caucasian and six were African-American, which was not racially-balanced. In addition, I did not further delimit the study by asking questions pertaining to the teachers' socioeconomic status or educational level. Therefore, these teacher participants may not be a representation of other rural elementary and middle-grade science teachers in the United States.

The last limitation dealt with data collection. In this study, I used interviews and a reflective journal. My study may have been strengthened had I also collected data from classroom observations and lesson plans. A longitudinal study may have also strengthened this study in seeing whether teachers' intentions remained or changed over a period of time.

Recommendations

I constructed the recommendations for future studies based on the study's main findings and results. The first recommendation is based on the results about rural elementary and middle-grade science teachers' intentions to integrate STEM career-related lessons during science instruction. My recommendation is that a need exists to conduct a qualitative, longitudinal study. I believe the ethnographic research design would be useful in this “extended contact” with elementary and middle-grade science teachers within rural communities (Miles, 2014, p. 8). I also believe an ethnographic research design would allow for “more purposeful observation” of the studied phenomenon (Miles, 2014, p. 8).

The second recommendation is based on the main finding pertaining to factors that affected rural elementary and middle-grade science teachers’ intention to integrate STEM career-related lessons during science instruction. This recommendation is to conduct a comparative analysis of STEM, STEAM, and STREAM. There exists no studies that examine the similarities and differences between STEM, STEAM, and STREAM. A comparative analysis would allow future researchers to provide readers with a clear picture of the similarities and differences within the languages of each program.

The third recommendation is also based on the main finding pertaining to factors that affected rural elementary and middle-grade science teachers’ intention to integrate STEM career-related lessons during science instruction. The recommendation is to conduct a case study on teachers’ perceptions of the impact of students’ reading ability on STEM career-related lesson integration during the science instructional period. A case study would afford future researchers the opportunity to collect data from several sources including documents and various settings.

The fourth recommendation is also based on the main finding pertaining to factors that affected rural elementary and middle-grade science teachers' intention to integrate STEM career-related lessons during science instruction. The recommendation is to conduct a transcendental phenomenological study on administrators' perceptions of teacher support in STEM career integration. The transcendental phenomenological design would allow future researchers to study administrators' experiences through the administrators' consciousness in relation to the studied phenomenon.

Implications

The findings produced several implications for positive societal change. The first implication for positive societal change deals with teachers. Teachers can understand and appreciate the demands placed on other teachers. Therefore, this knowledge may help teachers recognize the importance of collaborating with other teachers. After reading the results of this study, teachers may realize the existence of other like-minded teachers and may devise a plan to network with other teachers.

An additional implication for social change dealing teachers is this study could heighten awareness of the influence teachers had on students' pursuit of a STEM-related career path. This influence might lead to more teachers modifying their beliefs about STEM careers. If teachers were influenced to modify their perceptions about STEM careers, then teachers might view students' entry into STEM careers as a valuable outcome. Under the theoretical lens of Ajzen (1988 and 1991), the teachers' intentional desire to integrate STEM career-related lessons may overshadow any potential barriers that inhibit them. This may thereby lead to additional rural elementary and middle grade teachers integrating STEM career-related lessons during science instruction and thereby intensify the frequency of such integration experiences. Also, teachers of other subject areas may be inclined to take more heed of STEM and STEM practices and may incorporate STEM and/or STEM career-related lessons into the courses they teach.

A second implication for social change involves administrators. The second implication for social change is administrators may be become more informed of how teachers' intentions impact science instruction and teachers regular integration of STEM career-related lessons during their science instructional periods. This information might assist with the designing of localized professional development geared toward training more teachers to engage in STEM career integrating during science instruction. Therefore, administrators should become more educated about teachers' perceptions of STEM career-related lesson integration and should partner with teachers in their STEM integration efforts. This study could help administrators and teachers unite their efforts in constructing a positive climate of STEM career-related lesson integration.

The third implication for social change involves the community. This study may be of benefit to communities who are home to STEM-related businesses and/or are making a case to attract additional STEM jobs to their areas. The results could inform the community of measures teachers are doing to encourage students into STEM careers and assist with the identification of additional measures still needed. Ultimately, this study may lead to an increase in community partnerships between teachers and STEM-related businesses. It could also present additional opportunities for those who already integrate

STEM career-related lessons during science instruction to collaborate with community partners.

The last implication applies to positive social change with respect to society. Members of society are impacted by a rapidly, changing global society that is further influenced by international competitiveness. Knowledge about how rural elementary and middle-grade science teachers intend to integrate the STEM careers society needs into their science instruction is limited. Thus, additional studies are needed for an increased understanding of how teachers in rural areas intend to integrate STEM career-related lessons amid challenges rural teachers face within education. This study may spark interest in other researchers to examine other rural areas in the United States about teachers' STEM career-related lesson integration intentions and challenges encountered.

Fortified with knowledge from such studies, administrators may make greater effort to host more STEM nights and career fairs that may further assist teachers with encouraging students in STEM careers. Also administrators may do more to assist teachers with providing students with field experiences, attracting community partnerships, and securing funding. Ultimately, the number of students expressing interest in STEM careers may improve as administrative support of teachers improves. This study would also be of benefit to readers as extended is the opportunity to learn how a specific subset of teachers integrates STEM career-related lessons during their science instructional periods and how such teachers persevere through challenges to fulfill their intentions. Hence, the readers' understanding of teachers' intentions to integrate STEM career-related lessons would be augmented.

Conclusion

The findings of this study support assisting rural elementary and middle-grades science teachers with STEM career integration. This conclusion aligns with current research about the difficulties rural educators face with educational policy implementation. The findings of this study suggest educators need more support from their administrators, colleagues, and community partnerships in fulfilling their intents to integrate STEM career-related lessons during science instruction. In regards to this support, this study provides evidence that conversations are needed between teachers, administrators, and the community to create a clear path towards improving the numbers of students expressing interest in STEM careers. In addition, teachers express the need for additional training, collaboration, and resources as teachers whole-heartedly believe the facilitation of STEM career-related lessons to be their responsibility. The results of this study also indicate that in spite of challenges, rural elementary and middle-grade teachers see the importance of STEM career-related lesson integration in impacting their students’ futures. This study also augments findings of other studies with respect to strategies teachers use for STEM career integration. Researchers and scholar-practitioners would benefit from additional research that studies teachers’ intentions rather than just the behaviors while ignoring the underlying causes of these behaviors.

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Appendix A: Interview Questions

The specific questions I will use to guide my interviews with the 10 teacher research participants include:

1. How do you describe your intention to integrate STEM career-related lessons into the science courses you teach?
2. What role do your intentions play into the frequency in which you integrate STEM career-related lessons during science instruction?
3. What are your beliefs about the integration of information about STEM careers into science courses?
4. What do you believe about the teacher's responsibility to encourage students to become more interested in STEM careers?
5. How do you believe the emphasis on state standards and state assessments impacts your preparation of students for careers in science?
6. What influence would you describe your administration as having on your integration of STEM career-related lessons into the science courses you teach?
7. What information do the textbook and instructional materials you use include about science careers?
8. How do you describe your capability to integrate information about STEM careers into the science courses you teach?

These eight interview questions have been aligned with the research and sub questions to explore how intentions impact rural elementary and middle-grade teachers' actual integration of STEM career-related lessons into science instruction.

Appendix B: Reflective Journal Questions

1. Reflective Journal Question 1: What successes and challenges have you had with fulfilling your intentions to integrate STEM career-related lessons into the science courses you teach?
2. Reflective Journal Question 2: Why do you, or do not, believe you should encourage students in the grade level you teach to explore science careers?
3. Reflective Journal Question 3: What specific factors and/or needed resources do you see as enabling or preventing your intention to integrate STEM career-related lessons during science instruction?

Appendix C: Alignment of Interview Questions with Research Questions

Research Questions (RQ)	Interview Questions (IQ)	Reflective Journal Questions (RJQ)
RQ1: What are intentions of rural elementary and middle-grade science teachers as it pertains to integrating STEM career-related lessons during science instruction?	IQ1: How do you describe your intentions to integrate STEM career-related lessons into the science courses you teach? IQ2: What role do your intentions play in the frequency with which you integrate STEM career-related lessons during science instruction?	RJQ1: What successes and challenges have you had with fulfilling your intentions to integrate STEM career-related lessons into the science courses you teach?
SQ1: What do rural elementary and middle-grades science teachers believe about integrating STEM career-related lessons during instruction in the elementary and middle-grades? (Part of Ajzen's attitudes)	IQ3: What are your beliefs about the integration of information about STEM careers into science courses? IQ4: What do you believe about the teacher's responsibility to encourage students to become more interested in STEM careers?	RJQ2: Why do you, or do not, believe you should encourage students in the grade level you teach to explore science careers?
SQ2: How do rural elementary and middle-grade science teachers describe influence from subjective norms in integrating STEM career-related lessons during science instruction to elementary and middle-grade students? (Subjective Norms)	IQ5: How do you believe the emphasis on state standards and state assessments impacts your preparation of students for careers in science? IQ6: What influence would you describe your administration as having on your integration of STEM career-related lessons into the science courses you teach?	
SQ3: What factors do rural elementary and middle-grade science teachers	IQ7: What information do the textbook and instructional materials you use include about	RJQ3: What specific factors and/or needed resources do you see as

describe as impacting their participation in integrating STEM career-related lessons during science instruction to elementary and middle-grade students? (Part 1 of Perceived Behavioral Control)	science careers?	enabling or preventing your intention to integrate STEM career-related lessons during science instruction?
SQ4: How do rural elementary and middle-grade science teachers perceive their capability to integrate STEM career-related lessons during science instruction to elementary and middle-grade students? (Part 2 of Perceived Behavioral Control and part of attitudes)	IQ8: How do you describe your capability to integrate information about STEM careers into the science courses you teach?	