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Title I Middle School Teacher and Principal Perspectives on Inquiry-Based Science Instruction

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This is to certify that the doctoral dissertation by

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Walden University
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Abstract

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Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

Education Policy, Leadership and Management

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Abstract

Title I middle schools face challenges delivering effective inquiry-based science instruction within the framework of Title I requirements. The purpose of this basic qualitative study was to explore Title I middle school teacher and principal perspectives on and experiences with the challenges of delivering inquiry-based science instruction within the framework of Title I requirements. Dewey’s theories of experiential learning and Vygotsky’s theory of sociocultural constructivism provided the conceptual framework for this study. The research questions focused on teacher and principal experiences with inquiry-based science instruction and the impact Title I school policies and practices had on the delivery of inquiry-based science instruction. Interviews were conducted with 11 science teachers and two principals in Title I middle schools. Participants held careers in education for a minimum of 3 years. Open coding was used to support thematic analysis. Findings that emerged include inquiry-based science instruction is the preferred instructional strategy, the need for professional development aligned with collaboration, teacher-centered instruction is ongoing and recurrent, and science needs to be a priority content area in Title I improvement plans. The identified perspectives inform mentoring support and the communication of a clear vision to positively impact the implementation of inquiry-based learning in the classroom. Improving the quality of teaching through the unencumbered delivery of inquiry-based science instruction may have social change implications for student success in school, higher education, and employment prospects, thus influencing the economic growth of communities and improving social mobility across generations.

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Chapter 1: Introduction to the Study

Introduction

As students graduate and enter the workforce, the most highly valued skills that employers seek are written and oral communication skills, critical thinking skills, the ability to apply knowledge, teamwork skills, and ethical decision-making skills (Hart Research Associates, 2016). The use of inquiry-oriented approaches to learning can meet the demands of these required skills and promote environments for students to construct their learning outside of traditional, direct instruction (Chu et al., 2017).

Despite the best efforts of the U.S. Department of Education, state educational agencies (SEAs), and local educational agencies (LEAs), the obligation to develop student analytical and critical thinking in science education has not been met (Henderson et al., 2015). As teachers increasingly focus classroom instructional time on the state's standard course of study and specific objectives, students are told exactly what they will learn in the science classroom, and students often unquestioningly accept scientific content and concepts without learning how to ask questions and defend their beliefs (Marshall et al., 2017). This exclusion of inquiry has become a common practice in schools of poverty, also known as Title I schools, as teachers focus more on basic tasks: disseminating information, providing directions, assigning homework, managing classrooms, and posting grades (Giesige, 2017). This systematic approach to instruction creates a pedagogy of poverty (Haberman, 2010). In this study, I addressed the need to bring student achievement to acceptable levels in Title I middle schools.

In this study, I explored southeastern Title I middle school teacher and principal perspectives about whether existing policies and available school and classroom support within a Title I middle school learning community impede or support inquiry-based science pedagogy and the cultivation of skills of investigation and an understanding of scientific inquiry. Empirical evidence shows inquiry-based learning can foster meaningful understanding of concepts and cause positive gains in standardized assessment scores when teachers foster inquiry in the classroom and provide inquiry opportunities for students (Darling-Hammond et al., 2020; Dorph et al., 2018; Giesige, 2017; Scogin, 2016; Shumow & Schmidt, 2014). There is an urgency to prepare students in science or technology fields by providing the skills required for technological innovation, and transformational leaders must guide educators on how to develop and implement instruction for students to establish a school climate conducive to student achievement (Gurr et al., 2010; Larmer, 2016; National Science and Technology Council, 2018; Scogin, 2016). Without preparation, students from Title I schools will enter the workforce with extensive skills gaps, lowered economic prospects later in life, and little influence on the economic growth of their community, thereby perpetuating a lack of social mobility across generations (Garcia & Weiss, 2017; Suggs, 2017). This study may help to fill the gap in understanding the challenges faced by middle schools delivering inquiry-based science instruction to improve academic achievement within the framework of Title I requirements.

In this chapter, I provide a background of inquiry-based instruction; a statement of the research problem and purpose, the research questions, the conceptual framework that grounded the study, and the nature of the study; definitions of terms and clarification of assumptions, limitations, scope, and delimitations of the study; and the significance of the study. The final section summarized the main ideas of Chapter 1.

Background

The beneficiaries of successful inquiry-based science instruction are students who learn how scientific understanding is reached. Inquiry-based science instruction can provide students with experiences that increase self-efficacy as they pose probing questions and investigate them to find answers (Hong & Vargas, 2016). Students are encouraged to construct their understanding of science instead of being provided the information by a teacher. Science education activities promote critical thinking with an approach that develops intellectual habits students can use successfully in their lives (Fitzgerald et al., 2019). This is supported by National Science Education Standards that seek to support the vision for the science classroom by providing educators the content knowledge, understanding, and disposition necessary to deem students scientifically literate (National Research Council [NRC], 1996).

Existing research in teaching and science instruction supports an inquiry-based approach. Furtak et al. (2012) conducted a meta-analysis of 37 experimental and quasi-experimental studies published between 1996 and 2006 that establish a framework for inquiry-based teaching that distinguishes teacher guidance from student-led conditions. Findings confirmed a direct connection between inquiry-based teaching and improved student learning and indicated teacher-facilitated activities have a larger effect size than student-led conditions (Furtak et al., 2012). Abdi (2014) conducted a study that showed students in science classes who are instructed through inquiry-based learning achieve higher scores than those instructed through the traditional learning method. Students begin to see science as important when more emphasis is placed on relevant real-world science, and they are enabled with intellectual tools they can use to make sense of the world around them (Kliebard, 1995).

In the post-*Sputnik* era from 1957 to 1980, increased interest in student performance became the focus as governments called for quality education and higher standards (Committee on Science, Engineering, and Public Policy, 2007). This movement heralded a change in high stakes testing that emphasized student performance to reflect a minimum degree of learning. Originally, standardized tests were used to assess aptitudes and achievement and provide progress information to students and their families (Nichols & Berliner, 2007). These first high stakes tests were without consequence and informed decisions about curriculum and instruction. Since the 1980s, schools have become more focused on standardized high stakes testing and punitive policies and less focused on critical thinking, which creates “dead zones of the imagination” (Giroux, 2016, p. 351). This shift has been largely driven by new approaches to the management of educational systems.

By the 1990s and the advent of standards-based reforms, high stakes testing results were linked to students and their teachers (Morgan, 2016). High stakes testing policies were designed to have the same assessment processes for students, teachers, and schools throughout a system to judge schools by the same measurement criteria (Farvis & Hay, 2020). With the passing of the No Child Left Behind Act (NCLB) of 2002, high stakes testing became policy (Nichols & Berliner, 2007). This change to high stakes testing was driven by policy makers who wanted to ensure all students had access to a quality education mandated by the state; NCLB was designed to hold schools accountable for the achievement of all students (Farvis & Hay, 2020). The inclusion of consequences increased student disengagement from school, cheating by students and educators (Morgan, 2016), and teaching to the test (Scogin et al., 2017). By 2012 and the publication of *The Nation's Report Card: Trends in Academic Progress,* management of educational systems began to shift to the examination of performance groups and subgroups as in particular racial and ethnic groups, particular school districts, or other segments of student populations (White et al., 2016). When the Every Student Succeeds Act enabled a more comprehensive look at accountability, the change from a narrowed focus on raising test scores was welcomed by advocates for students from historically underserved groups who demanded a whole-child approach to academic development (Darling-Hammond et al., 2020).

Public education and the school environment are directly influenced by market-driven school reforms that include teacher merit pay, charter schools, school closures, and high stakes testing for determining student achievement as well as school quality (Scott & Holme, 2016). Research supports the need to establish a clear understanding of the relationship between pedagogy, politics, and democracy. For inquiry-based science instruction to be effective, science teachers must have a sense of autonomy over their conditions (Brown & Hattie, 2012; Darling-Hammond & DePaoli, 2020; Hong & Vargas, 2016).

Furthermore, the support of school leaders is critical in the implementation of inquiry-based science instruction. The manner in which principals engage with and address the data-driven accountability measures of Title I and local mandates reveals their approach to negotiating and mediating to comply with Title I testing and data-monitoring policy directives—managing data with electronic data management software, quantitatively calculating and comparing academic achievement, and publicly displaying achievement data (Dotson & Foley, 2017; Koyama, 2014). Principals who address accountability measures and support teachers with resources and classroom autonomy positively impact the implementation of inquiry-based learning in the classroom (Baptiste, 2019; Geiger & Pivovarova, 2018; Pea, 2012).

The Title I section of the Elementary and Secondary Education Act (ESEA) was developed as financial assistance to LEAs for the education of students of low-income families (U.S. Department of Education, 2018). Despite the infusion of money ESEA has provided, the achievement gap has not been substantially closed (Darling-Hammond, 2018; Hanushek et al., 2019; Ladson-Billings, 2015; Michelmore & Dynarski, 2017). The initial science experience of students of low-income families is a predictor of their later science achievement (Morgan et al., 2016). By actively engaging students in science instruction, teachers will help students improve their academic achievement (Hirn et al., 2018).

Studies exist that address middle school science educator perspectives on implementing inquiry-based instruction (Blanchard et al., 2013; DiBiase & McDonald, 2015; Hong & Vargas, 2016; Scogin, 2016), but a gap in the literature exists as it relates to middle school teachers' and principals' perspectives on inquiry-based instruction in the science classroom within the framework of Title I requirements. By exploring teachers' and principals' perspectives, I sought to present Title I middle school teachers' and principals' interpretations of inquiry-based instruction in their classroom or in their district. Through the inclusion of teachers' and principals' knowledge, needs, and perspectives, this study may provide information on the extent to which Title I requirements challenge the delivery of inquiry-based science instruction in the middle school learning environment and may contribute to producing more effective teaching practices.

Statement of the Problem

This study addresses the gap in research by exploring and describing the problem that Title I middle school teachers face challenges delivering effective inquiry-based science instruction within the framework of Title I requirements. Research suggests teachers are aware of the positive results from using inquiry-based methods to increase academic achievement but are not able to translate that knowledge into competent practice (Fitzgerald et al., 2019; Herrington et al., 2016; Keiler, 2018; Marshall et al., 2009). Teachers find it challenging to implement inquiry-based instruction on a consistent and regular basis because of the increased emphasis on high stakes measurements of accountability (DiCicco et al., 2016; Marshall et al., 2017) and high teacher turnover and attrition rates (Carver-Thomas & Darling-Hammond, 2017; Sutcher et al., 2016).

Researchers in five studies compared traditional teacher-centered instruction to inquiry-based learning and concluded that inquiry-based learning produced higher academic outcomes (Chen et al., 2015; Han et al., 2015; Hiller & Kitsantas, 2014; Horak & Galluzzo, 2017; Scogin et al., 2017). Gormally et al. (2009) found improvements in science literacy and skill were attained from inquiry-based science instruction; however, traditional instruction had a greater gain in academic achievement. Opponents of inquiry-based instruction believe it to be an impractical approach to science education as it does not provide the scaffolding to learn specific concepts or the processes of science (Kirschner et al., 2006). Nonetheless, there has been no research specific to the context of inquiry-based science instruction in Title I schools.

According to Darling-Hammond (2018), teachers and principals who work within the constrictive and challenging Title I framework underperform despite best efforts. Researchers have suggested that further studies are needed to understand effective inquiry-based science instruction and student achievement in the constructs of Title I requirements (Blanchard et al., 2013; Hirn et al., 2018). The National Science Education Standards call for the use of inquiry in the science classroom (NRC, 1996). The standards present a vision for science education that emphasizes engaging students in the critical thought process that may lead to scientific and technological breakthroughs. These standards further support the significance of this study in which I explored and described effective inquiry-based science instruction and Title I requirements. This study may support and guide Title I science educators in bringing student achievement to acceptable levels.

Purpose of the Study

The purpose of this basic qualitative study was to explore Title I middle school teacher and principal perspectives on and experiences with the challenges of delivering inquiry-based science instruction within the framework of Title I requirements. Using semi structured interviews with open-ended questions, I sought to learn participants' insights into an understanding of the degree to which inquiry-based instruction is occurring in the science classroom. The findings may inform effective practices and actions that might be considered by academic leaders to increase the use of inquiry-based science instruction in Title I middle schools.

Research Questions

The following three research questions were central to gathering study data:

RQ1: What are the perspectives on and experiences with inquiry-based instruction within the framework of Title I requirements of science teachers in a Title I middle school?

RQ2: What are the perspectives and experiences of Title I middle school principals regarding the challenges to the successful delivery of inquiry-based science instruction within the framework of Title I requirements?

RQ3: How do Title I middle school policies and practices impact the delivery of inquiry-based science instruction within the framework of Title I requirements?

Conceptual Framework

The conceptual framework for this study consisted of a combination of Dewey's theories of experiential learning and Vygotsky's theory of sociocultural constructivism.

Dewey is important as a philosopher whose ideas are still relevant to current discussions about knowledge and education. Dewey (1916) found that experiences, through adaptive responses or through experimental processes and methods of active inquiry, determine the value of and possible solutions to problematic situations. Dewey (1910) proposed experiential learning provided students with opportunities to engage in science not just as an active adaptive response, but also as a reflective process of the how and why a desired end is attained. This shifted the focus of the science classroom from an emphasis on just facts to an emphasis on operative thinking and attitude of the mind.

Lev Vygotsky's (1978) constructivist approach suggests student learning is mediated in an interactive environment where students can construct understanding through social interactions. For Vygotsky, the classroom is also a social organization representative of the larger social community. However, instead of the individual as an agent for change in the social organization, the social organization and the larger social community are the agent for change in the individual (Vygotsky, 1978). The purpose of education is to meld children into the larger social structure so they become productive members of the community. The structured teaching environment of constructivism suggests learners engage with primary sources, manipulatives, and interactions with others (Schunk, 2012).

Dewey's (1910) experiential learning and Vygotsky's (1978) sociocultural learning converge on the concept of student-centered active learning. The intersection between student thinking and the influence of the social, cultural, historical, and institutional setting where the student lives frames the student's engagement in the construction of meaning (O'Loughlin, 1992). Contemporary models of inquiry-based instruction build on these theoretical frameworks by emphasizing the importance of a learner having the opportunity to explore scientific concepts before formal explanations of the phenomena are provided, thus facilitating conceptual understanding (Bransford & NRC, 2000; Bybee et al., 2006).

Research provides evidence that inquiry-based instruction using an explore before explaining practice produces positive student outcomes in science (Bybee et al., 2006; Marshall et al., 2017; Vygotsky, 1978). Dewey's (1910) experiential learning and Vygotsky's (1978) sociocultural learning directly align with the pedagogical beliefs and effective inquiry-based science instruction found in research. In this study, the constructs of inquiry-based science instruction and Title I requirements provided the data analysis basis for coding and examining emergent themes. Inductive coding analysis of data was used to classify information into meaningful categories for consistent interpretation (Frankfort-Nachmias & Leon-Guerrero, 2016).

Nature of the Study

Qualitative researchers explore and describe socially constructed meanings of individuals as a result of interactions with their world (Merriam & Tisdell, 2016). A basic qualitative study can include data collected from observations, through interviews, or by analysis of documents to capture the descriptive accounts of participant experiences (Merriam & Tisdell, 2016; Patton, 2015). I conducted this research study using a basic qualitative research design. Qualitative research is consistent with understanding Title I middle school teacher and principal perspectives on and experiences of inquiry-based science instruction at their school, current participation in using inquiry-based science instruction at their school, and challenges of delivering inquiry-based science instruction within the framework of Title I requirements.

In this study, I focused on principal and teacher experiences with inquiry-based instruction in the science classroom in a Title I school. I interviewed sixth through eighth grade science teachers and the principals of Title I middle schools to gather their experiences with inquiry-based science instruction. I selected these grade levels because according to the National Science Teaching Association (2003) position statement, middle school years are a pivotal time in student processing of scientific concepts and their excitement for learning science. In this study, I describe the experiences of participants who work in nine southeastern Title I middle schools within a 10-mile radius. I did not consider the other nine Title I middle schools in the district. The actual number of participants was 11 teachers and two principals. Data collection occurred through semi structured interviews with open-ended questions. The constructs of inquiry-based science instruction and Title I requirements provided the data analysis basis for coding and examining emergent themes. Inductive coding analysis of data was used to classify information into meaningful categories for consistent interpretation (Frankfort-Nachmias & Leon-Guerrero, 2016).

Definitions

The following definitions were used in this study of middle school experiences with inquiry-based instruction in the science classroom.

Accountability system: Each state sets academic standards for what every child should know and learn. Student academic achievement is measured for every child, every year. The results of these annual tests are reported to the public (U.S. Department of Education, 2017).

Achievement gap: The difference between how well low-income and underrepresented groups of children perform on standardized tests compared with their peers. (U.S. Department of Education, 2017).

Adequate yearly progress (AYP): The minimum level of improvement that states, school districts, and schools must achieve on state academic standards each year (U.S. Department of Education, 2017).

Educators: All education professionals and paraprofessionals working in schools, including principals or other heads of a school, teachers, other professional instructional staff, pupil support services staff, other administrators, and paraprofessionals (U.S. Department of Education, 2018).

Environmental factors: Aspects of the human environment (e.g., students, teachers, peers, principals, parents, and other stakeholders); sociocultural environment (e.g., culture, diversity, policy); or design environment (e.g., facilities, materials, and equipment; Bandura, 1997).

High stakes testing: The use of standardized student achievement tests as a primary mechanism to evaluate the performance of students, teachers, and schools (Natriello, 2009).

Inquiry-based science instruction: A process of discovering new relations with the learner formulating hypotheses and then testing them by conducting experiments and/or making observations (Pedaste et al., 2012).

Low-performing schools: Schools in the bottom 10% of performance in a state or who have significant achievement gaps based on student academic performance in reading/language arts and mathematics on the assessments required under the ESEA or graduation rates (U.S. Department of Education, 2018).

Middle school: Instruction in Grades 6 through 8 (U.S. Department of Education, 2008).

Title I: The first section of the ESEA refers to programs aimed at America's most disadvantaged students. Title I Part A provides assistance to improve the teaching and learning of children in high-poverty schools to enable those children to meet challenging state academic content and performance standards. Title I affects about 12.5 million students enrolled in both public and private schools characterized by a population of at least 40% of students from low-income families (U.S. Department of Education, 2018).

Traditional learning: Prescribed instructional sequences using static materials; consistent focus on content objectives; emphasis on explanation, assessment, and correction of errors; feedback to students and assignments; and review in which the teacher is doing all these things (Haberman, 2010; Scogin et al., 2017).

Assumptions

The assumptions surrounding the study were beyond my control but are relevant (Simon & Goes, 2012). First, I assumed the educators were familiar with inquiry-based science instruction that was part of this study. Second, I assumed the educators were familiar with Title I and its requirements that were part of this study. These assumptions were necessary to the context of the study, as educators need to be familiar with inquiry-based science instruction within the framework of Title I requirements to facilitate the quest for access to equitable, empowering education for all students. Third, I assumed the research questions were adequate and significant in detail to permit a developed understanding of educator perceptions. The fourth assumption was that the time and physical location of the interviews would not influence interviewee responses. Interviews took place using teleconferencing. Finally, I assumed participants' recollection of inquiry-based delivery experiences would be accurate.

Scope and Delimitations

In this study, I addressed the gap in research by exploring and describing the problem that Title I middle school educators face challenges delivering effective inquiry-based science instruction within the framework of Title I requirements. The research problem was chosen to address a gap in exploration of Title I middle school teacher and principal perspectives on and experiences of inquiry-based instruction in the science classroom within the framework of Title I requirements. The conceptual framework for this study was based on a combination of Dewey's (1916) theories of experiential learning and Vygotsky's (1978) theory of sociocultural constructivism. Piagetian constructivism was considered but not included as it focuses on individual student cognitive development and how they learn and denies the collaborative and social nature of meaning making among students (O'Loughlin, 1992).

According to Yin (2013), the scope of a study is narrowed by the delimitations to ensure the study is complete. Completeness is achieved by using elements that outline the boundaries and limit the scope of the study. The scope of this study comprised 11 middle school science teachers and two middle school principals working in Title I schools in a large southeastern school district. Delimitations were factors that narrowed the scope of the study, defining parameters for participants, data collection, and time frame. Also included in delimitations were statements about what the study did not include (Burkholder et al., 2016). The delimitations of the study were that only nine Title I middle schools were selected, the participants were sixth through eighth grade science teachers and principals who served in their current assignment for at least 3 years. Furthermore, delimitations were that data were collected through teleconferencing interviews, and other administrators, substitute teachers, or any other stakeholders were not included in this study. To address the possibility of conflicts with the availability of teachers and principals for interviews, I offered a variety of times for interviews using an online meeting application. Only results from this population of educators were included, thus omitting educators from other grades and Title I middle schools.

Questionnaires were not included in this study to focus on in-depth interviews to explore and describe educators' authentic perspectives within their learning community. Qualitative researchers seek to understand participants' unique experiences related to a specific setting and context (Ravitch & Carl, 2016). I carefully selected participants who taught sixth through eighth grade levels, and while this may have increased the dependability of the findings, it may have decreased transferability to teachers' experiences at other grade levels facing different challenges. Results of the study may be transferrable to other educational settings by taking consideration to understand the demographics and the descriptions of this study’s procedures, context, participants, and their experiences.

Limitations

The potential shortcomings or weaknesses of a study can affect the results of the study and the inferences drawn from the data (Burkholder et al., 2016). Limitations for this study included the availability of teachers and principals for in-person interviews, sample size, and my interpretation of data. I was the sole person responsible for collecting the data. As an educator in the district, I have potential bias as I have taught science all my teaching career at a high school within the district. I do not have any formal or informal supervisory role with the educators I interviewed. However, the findings of this study may be transferable to other educational contexts. The limitations of data interpretation were addressed by consistently using concept codes to interview transcript data (Creswell & Creswell, 2019). In addition, member checking was used to allow participants to review and validate my interpretations of the responses provided during the data collection interview process (see Ravitch & Carl, 2016).

Significance of the Study

Employment in science, technology, engineering, and mathematics (STEM) fields is directly related to the rate of economic growth. Preparing students in science or technology fields is more important than ever to providing the skills required for technological innovation (Giffi et al., 2018). However, the STEM economy is lagging in preparing students for the projected 6.4% of U.S. jobs that require knowledge in one of the STEM disciplines (Dailey & Robinson, 2016; Rothwell, 2013; U.S. Bureau of Labor Statistics, 2020). Scogin et al. (2017) found that middle school science teachers understand the importance of inquiry, but the focus of schools on required state curriculum for mandatory assessments cause teachers to choose between implementing inquiry-based instruction or traditional methods. According to Fitzgerald et al. (2019), teachers in schools with a high incidence of poverty feel they have less time to incorporate student-centered activities and more pressure to teach in a traditional fact-based method to prepare students for standardized tests. In addition, principals feel that innovative methods of instruction are not supported because testing policies drive instruction, including teaching to the test in which instruction is focused on items that appeared more frequently on standardized tests (Fitzgerald et al., 2019). By falling short of educational benchmarks, students from Title I schools will enter the workforce with extensive skills gaps, lowered economic prospects later in life, and little influence on the economic growth of their community, thereby perpetuating a lack of social mobility across generations (Garcia & Weiss, 2017; Suggs, 2017).

Inquiry-based science instruction provides activities that promote student innovation to meet the demands of science-related careers. Although some studies address middle school science educator perspectives on implementing inquiry-based instruction (Blanchard et al., 2013; DiBiase & McDonald, 2015; Hong & Vargas, 2016; Scogin et al., 2017), a gap exists in the literature as it relates to middle school teacher and principal perspectives on the delivery of inquiry-based science instruction within the framework of Title I requirements. Through the inclusion of educators' knowledge, needs, and perspectives, I focused this study on the impact of middle school policies and practices on the delivery of inquiry-based science instruction within a Title I framework. Improving the quality of teaching inquiry-based science instruction within the framework of Title I requirements may have positive social change for student learning and achievement as well as education in general.

Thus, this study provided insight into teachers' and principals' experiences with inquiry-based science instruction and the challenges Title I has on their instructional and curricular classroom activities. The data from this study may help education stakeholders examine science instructional practices within Title I middle schools and guide decisions on how science should be taught. Improving the quality of teaching through the unencumbered delivery of inquiry-based science instruction may have social change implications for students' success in school, higher education, and employment prospects, thus influencing the economic growth of communities and improving social mobility across generations.

Summary

The research problem in this study addressed the gap in exploration of Title I middle school teacher and principal perspectives on and experiences with inquiry-based instruction in the science classroom within the framework of Title I requirements (Blanchard et al., 2013; Hirn et al., 2018). The purpose of this study was to explore Title I middle school teacher and principal perspectives on and experiences with the challenges of delivering inquiry-based science instruction within the framework of Title I requirements. The gap in implementation addressed was that there are Title 1 middle schools in a large southeastern school district that acknowledge the use of inquiry-based science instruction may increase student achievement but educators in these schools are not using this instruction method effectively. Effective inquiry-based science instruction in Title 1 middle schools needs to be explored and described so new practices may be considered and operationalized to ensure all student demographics demonstrate academic growth. The three research questions were aligned to the problem and purpose of the study and were designed to explore and describe teachers' and principals' perspectives on implementing effective inquiry-based science instruction. Semi structured interviews were conducted to gather data to explore and describe teachers' and principals' perspectives on implementing effective inquiry-based science instruction in Title I middle schools where the participants held careers in education for a minimum of 3 years.

In Chapter 2, the literature review on effective inquiry-based instruction forms the conceptual framework for this study: experiential learning and sociocultural constructivism. The literature review begins with an overview of the history of inquiry-based science instruction aligned to supporting the needs of Title 1 schools. Next, the literature review includes both qualitative and quantitative studies that help identify and describe challenges to implementing inquiry-based instruction in middle schools.

Chapter 2: Literature Review

Introduction

In this study, I addressed the gap in research by exploring and describing the problem that Title I middle school educators face challenges delivering effective inquiry-based science instruction within the framework of Title I requirements. The purpose of this study was to explore Title I middle school teacher and principal perspectives on and experiences with the challenges of delivering inquiry-based science instruction within the framework of Title I requirements. The gap in implementation addressed in this study was there are Title 1 middle schools in a large southeastern school district that acknowledge the use of inquiry-based science instruction may increase student achievement but are not using it effectively. The data from this study may help education stakeholders examine science instructional practices within Title I middle schools and guide decisions on how science should be taught to improve academic outcomes for all students.

Effective science teaching has been aligned for decades with the use of an inquiry approach to learning (American Association for the Advancement of Science, 1993; Crowell & Schunn, 2016; Darling-Hammond et al., 2020; Furtak et al., 2012; Larmer, 2016; National Academies of Sciences, Engineering, and Medicine, 2016; NRC, 1996, 2012; Scogin et al., 2017). Inquiry-based instruction is recognized as a bridge for connecting ideas to coherent learning experiences and for actively engaging students in learning science. Continuous effort and resources have been spent supporting its use; however, consistent use of inquiry-based science instruction in the classroom is not evident (Capps et al., 2016; DiBiase & McDonald, 2015; Fitzgerald et al., 2019; Lakin & Wallace, 2015).

This chapter contains a review of the significant research literature regarding inquiry-based science instruction. I discuss inquiry-based instruction in terms of the history, evolution of science education, theory, practice, and influential empirical literature. The NRC's concept of actively engaging K–12 students in scientific and engineering practices will be analyzed for this study. In addition, I review Title I requirements for their impact on teaching practices found in the science classrooms of learning communities. Finally, I examine the variables associated with principal and teacher perspectives, and the link between principal and teacher perspectives and delivery of inquiry-based instruction. The chapter concludes with an examination of the instruments employed to address the research questions.

Literature Search Strategy

The literature review includes research-based and theoretical sources from journal articles, seminal works, and books. I acquired full-text journal articles from peer-reviewed journals. The databases used included Educational Resources Information Center (ERIC), Education Research Complete, EBSCO, ProQuest, Sage Publications, and Google Scholar. Other sources of research included the U.S. Department of Education websites and dissertations. The search was limited to English articles published 2017–2022. Search terms, descriptors, and keywords included *inquiry-based, inquiry method, inquiry learning, science, middle school, middle grade, Title I, Title 1, low income, underprivileged, principal, leadership, teacher perceptions,* and *teacher beliefs.* The search of the selected databases resulted in the retrieval of 26 documents with only three aligning with the Title I framework. Hand searching these documents resulted in the retrieval of an additional 121 documents for a total of 147 documents. Each of the articles retrieved were assessed by reading the abstract or the full document for alignment to the problem, purpose, and research questions of this study. Literature relevant to the constructs of the conceptual framework were selected for this study.

Conceptual Framework

To support the purpose of this study, the conceptual framework for this study consisted of Dewey's (1910) theories of experiential learning, and Vygotsky's (1978) theory of sociocultural constructivism. According to Dewey (1938), scientific problems to be studied must be approached using the scientific method: presentation of the problem, formulation of a hypothesis, collection of data during the experiment, and formulation of a conclusion. Not to be confused as a series of steps but rather criteria for reflection or problem solving with the teacher as the facilitator to keep students on track in the process of their own discoveries. Such problems must be related to students' experiences within their intellectual capability; therefore, students are actively making meaning of their experiences in their search for answers, and teachers facilitate the inquiry that results in learning (Chu et al., 2017; Kuhlthau et al., 2015). According to Vygotsky (1978), opportunities should be created for student learning to occur in a social setting; students develop knowledge through cooperative, social interactions in the classroom. Learning situations are created by teachers through demonstrations students can repeat, or through leading questions. These experiences allow students to build an understanding of the world through personal conceptualizations and make meaning of it (Eltanahy & Forawi, 2019; Marshall et al., 2017).

Inquiry-based teaching and learning in the science classroom is a constructivist approach that emphasizes understanding is actively constructed by students through their integration of subjective and cultural perspectives in a collaborative setting (O'Loughlin, 1992). The NRC's (2012) framework for K–12 science education provides a guideline for the inquiry-based science classroom that emphasizes Dewey's and Vygotsky's theories. This guideline seeks to promote a hands-on learning environment and a setting that fosters understanding of the processes of engaging in science more deeply. The framework focuses on actively engaging K–12 students in scientific and engineering practices to promote the use of inquiry-based instructional methods. Hong and Vargas (2016) used Dewey's theories to support their research of inquiry-based instruction as a method for moving the teacher away from presenting decontextualized scientific knowledge to interacting with students and the curriculum through stimulating questioning and investigation in the science classroom,

The conceptual framework of Dewey's (1910) experiential learning theories as well as Vygotsky's (1978) sociocultural learning theories support this study by serving as a lens for exploring and analyzing teachers' and principals' perspectives on and experiences of delivering inquiry-based science instruction in the framework of Title I requirements. Dewey and Vygotsky left a legacy of ideas that highlight the importance of activities in the classroom; such research benefits this study by confirming students enjoy science more, successfully collaborate with their peers, develop their noncognitive skills, and progress on standardized tests when inquiry-based instruction is effectively implemented in the science classroom (Eltanahy & Forawi, 2019; Horak & Galluzzo, 2017; Riegle-Crumb et al., 2019; Scogin et al., 2017).

Literature Review

Call for Science Literacy

The 21st century has a proliferation of necessities that drive the requirement for the young generation to be science literate (Andrini, 2016; Chu et al., 2017; Giffi et al., 2018; National Academies of Sciences, Engineering, and Medicine, 2016). Science literacy is the comprehension of acquired scientific knowledge that can be applied to make informed decisions in the world (NRC, 1996; National Science Foundation, 2018; Zucker, 2021). The global acceleration of technological advancement has created competition for scientific and technical talent. Such a diverse workforce requires a pathway to science literacy that can meet the demand for skills such as analytical thinking, communication, working with tools and technology, design, critical thinking, inference, as well as perseverance, collaboration, adaptability, and responsibility (Marshall, 2013; National Science and Technology Council, 2018). For the United States to lead and prosper in the rapidly advancing scientific and technology global marketplace, the pathway to science literacy must be through the improvement of science education (American Association for the Advancement of Science, 1993; Bybee et al., 2006; Marshall, 2013; NRC, 2000). The future depends largely on the wisdom with which science and technology is taught and used. This future is not limited to entertainment, cybersecurity, transportation, and climate changes, but also includes making personal health and nutrition choices, financial management, and parenting, thereby preparing people for more personally fulfilling and responsible lives (American Association for the Advancement of Science, 1990; NRC, 2012; National Science and Technology Council, 2018; Riga et al., 2017).

Employers have concerns that noncognitive skills are not being developed as their new hires are deficient in what they consider the most important skills: teamwork and collaboration, oral communications, professionalism and work ethic, and critical thinking and problem solving (Larmer, 2016; Scogin et al., 2017). When effective science teaching takes place in schools, students confidently graduate as citizens equipped with the ability and inclination to develop their career and actively participate in issues affecting their lives and community (NRC, 2012). The benefits of science literacy are universal and lead to an increasingly productive workforce that correlates to economic growth, state and federal monetary savings, reduced stress on the criminal justice system, and increased economic opportunities later in life (Bivens et al., 2016; Garcia & Weiss, 2017; National Science and Technology Council, 2018). The social world is complex and is characterized by heightened participation in upward social mobility, socialization into the local community and extensive cultures, and an increasingly informed citizenship, all of which rely on a deeper knowledge of science (Bivens et al., 2016; Chu et al., 2017; Fayer et al., 2017; Garcia & Weiss, 2017; U.S. Bureau of Labor Statistics, 2020).

History of Inquiry

According to DeBoer (2019), “If a single word had to be chosen to describe the goals of science educators during the 30-year period that began in the late 1950s, it would have to be inquiry" (p. 206). Inquiry has a long and persistent history as the focus of sound science teaching and learning (Anderson, 2002). The notion of scientific inquiry and its importance in public education was first credited to John Dewey (1910). Dewey (1938) believed the science classroom was a place for knowledge making and not for accumulating ready-made materials. Although many in academia were inspired by Dewey's approach to solutions through reflective thinking, resistance to these progressive principles continued; support for the approach was widespread but not universal (DeBoer, 2019). Some educators and scientists still saw the value in disciplinary science and in a traditional approach to science teaching.

Science teaching and learning did not change significantly until the end of World War II (Abrams et al., 2007) when the predominant belief was that a direct correlation exists between military and economic success and scientific expertise. Leadership in science education would come from the federal government in the development and dissemination of scientific knowledge (DeBoer, 2019). In 1958, Joseph Schwab, in speaking of the importance of science in terms of national security, influenced the trajectory for science education by stating that the teaching of science through inquiry requires students to undertake inquiries as the method for learning (Schwab, 1958). Students are called upon to use their judgement to make choices regarding equipment and materials, to plan procedures, to collect and analyze data to learn how scientific knowledge is generated, and to participate in the practices of science.

The successful launch of the Sputnik satellite by the Soviet Union, the Union of Soviet Socialist Republics, prompted many in the United States to question whether its educational system was suited to meet the demands of the 21st century (Committee on Science, Engineering, and Public Policy, 2007). Drastic education reforms were initiated to keep pace with advancing scientific and technological developments and to promote the United States as a leader among the rising number of international competitors in science and technology (Committee on Science, Engineering, and Public Policy, 2007; Meltzer & Otero, 2015; NRC, 1996).

A key influencer, Jerome Bruner, held a conference for scientists in 1959, with the objective of finding ways to make science education more engaging, useable, and meaningful to students (Bruner, 1976, p. 20). Bruner believed students construct knowledge based on past knowledge; therefore, instruction should be sequenced in progression from simple concepts, to questioning what is known, to manipulating information. Bruner focused on increasing science expertise by reforming education to prepare students to continually transfer learning and build on what they already learned in a spiral manner.

The work of both Schwab and Bruner were similar to Dewey's call for inquiry-based science instruction, which became evident in the 1970s when the National Science Foundation (1970) presented recommendations for the science curriculum. The curriculum reflected the belief that direct experiences promote students' understanding of scientific disciplines as characterized by practicing scientists (Bruner, 1976; Schwab, 1958).

In 1983, the National Commission on Excellence in Education (NCEE) report, *A Nation at Risk*, became an impetus for use of common core standards. The NCEE report asserted the nation's public education system was inferior in international comparisons (NCEE, 1983). The report put forth recommendations to improve science education in public schools, including the adoption of rigorous standards and curriculum. The report introduced the methods of reasoning and scientific inquiry, real-world applications of science, and the implications of scientific development.

Throughout the 1990s, the nation's public schools began implementing the first wave of standards-based reforms in response to the call from the federal government for science standards (Hanushek et al., 2019). Following the tenets of Dewey, Schwab and Bruner, inquiry-based science instruction became an essential component of effective science education. The *Science for All Americans* (American Association for the Advancement of Science, 1990) and the *Benchmarks for Science Literacy* (American Association for the Advancement of Science, 1993) publications shaped the *National Science Education Standards* (NRC, 1996) which provided benchmarks for evaluating the progress of learning and teaching inquiry-based science. The *National Science Education Standards* are the basis for teaching, professional development, assessment, and content of science education programs and science education systems used today.

According to the NRC (2012), eight practices in science are essential for classroom curriculum. These practices include: (a) asking questions (science); (b) developing and using models; (c) planning and carrying out investigations; (d) analyzing and interpreting data; (e) constructing explanations (science); (f) engaging in argument from evidence; and (g) obtaining, evaluating, and communicating information (2012, p. 49). With these practices as their objective, a committee of educators and scientists developed a three-dimensional conceptual framework called *A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas* (NRC, 2012) designed to actively engage science students through learning experiences that deepen their understanding of the world around them using scientific investigative methods. This framework provided the three dimensions of learning that were combined to form the current science standards known as the *Next Generation Science Standards*, NGSS (NRC, 2013). Science educators use NGSS as a guideline for what they should know and be able to do to teach and, for each grade level, what students should know and be able to do to be scientifically literate. Although some teachers believe the time needed to implement inquiry lessons will prevent them from covering all NGSS for their course (DiBiase & McDonald, 2015), teachers must make judicious choices regarding which lessons can best be learned through inquiry for a deeper understanding of science content (NRC, 2000). The NGSS do not suggest that all science should be learned through inquiry.

Developmentally Responsive Middle School

The developmentally responsive middle school classroom embodies the goals of addressing the unique needs of young adolescents as identified by the 1950 middle school concept (DiCicco et al., 2016; Manning, 2000; National Middle School Association, 1995; Robinson, 2017; Schaefer et al., 2016). Between the ages of 10 and 15, changes in the way young adolescents think and learn becomes evident in the way they reflect about their life, critique moral issues, conceptualize ideas, perceive images and humor (National Middle School Association, 1995; Schaefer et al., 2016).

Through the lens of the developmental needs of the young adolescent, teachers in middle school classroom support their cognitive, emotional, moral, physical, and social development (Chen et al., 2012; Cook et al., 2016; Hammerness et al., 2004). The young adolescents' search for a sense of self through interactions with peers, teachers, parents, and other family members drives their desire for independence and exploratory learning (Cook et al., 2016; Manning, 2000; National Middle School Association, 1995). The middle school concept posits that the interdependence of a culturally responsive active learning curriculum, strong counseling programs, interdisciplinary teams of teachers, block scheduling, exploratory programs, and shared decision making among parents and the community educates the whole, young adolescent within the context of today's dynamic and diverse, education climate (Bishop & Harrison, 2021; Cook et al., 2016; Robinson, 2017; Schaefer et al., 2016). In this middle school learning environment, young adolescents develop more abstract ways of thinking, systematic approaches to creative thinking and the ability to articulate solutions to problems within their own experiences thereby empowering the adolescent in their learning (Cook et al., 2016; National Middle School Association, 1995; Robinson, 2017).

The year 1963 is generally accepted as the beginning of the middle school movement in the U.S. Researchers have analyzed the effects of the middle school movement and described its success in various state-wide implementations (Bishop & Harrison, 2021; Cook et al., 2016; Lounsbury, 2009, 2010). Middle schools must consider the context of their learning community to ensure decisions are developmentally responsive. Implementing a true middle school concept requires changes that contradict established school procedures; hence the spirit of the vision must drive the moral imperative to advance the education and well-being of young adolescents (Bishop & Harrison, 2021; Chen et al., 2012; Cook et al., 2016; Lounsbury, 2009; Manning, 2000; Robinson, 2017). Building a model that advocates for young adolescents and rejects policies that do not draw out their inherent capabilities and inspire their growth, affords young adolescents the opportunity to thrive now and in the future.

Inquiry-Based Science Instruction

The term "inquiry" has various and often conflicting meanings in science education depending upon the interpretation of the individual researcher. To find consensus among the various scientific, educational, and public contributors to science education, the National Science Education Standards contain the most thorough definition of competencies for scientific inquiry, inquiry learning, and inquiry teaching. Scientific inquiry "refers to the diverse ways in which scientists study the natural world and propose explanations based on the evidence derived from their work" (NRC, 1996, p. 23). This use of the word "inquiry" reflects an understanding of how science takes place, independent of how it is taught. Inquiry learning refers to a student's active learning process. Inquiry is "something that students do, not something that is done to them" (NRC, 1996, p. 2). This learning should reflect the same processes that take place in scientific inquiry, but the learning takes place in an educational setting.

Inquiry may be completed in one lesson or a long-term project that focuses on a problem to be solved or a probing question that requires developing an appropriate methodology to answer the question, making decisions about reliable evidence, and reaching credible conclusions using tools like research and technology (Darling-Hammond et al., 2020; Scogin, 2016). In contrast, traditional education is a teacher-directed instruction of science using primarily static materials (Dewey, 1938). The focus of instruction is on the teacher as opposed to student-centered learning. In most science classrooms, student interest in science wanes because of rote learning and top-down instruction within the traditional classroom (Chu et al., 2017; Giroux, 2016; Mehta, 2020). Without a clear understanding of how the instruction has any meaning in their world outside of the classroom or what is the significance in their future life or livelihood, students become disengaged, scrambling for grades at the expense of intellectual curiosity (Chu et al., 2017; Mehta & Fine, 2019). Inevitably students become demotivated, bored, and frustrated (Chu et al., 2017; Giroux, 2016; Vedder-Weiss & Fortus, 2018) and disinterest in science continues to decline with age.

A common goal of science instruction is to promote scientific literacy among K-12 students using inquiry (Crowell & Schunn, 2016; DeBoer, 2000; National Academies of Sciences, Engineering, and Medicine, 2016; Shumow & Schmidt, 2014). Inquiry instruction and learning refers to an approach in which students identify the problem to study; generate questions about the problem; design their investigations; record their observations; interpret the generated data; create explanations, models, and arguments; and then report their findings (Marshall et al., 2017; NRC, 1996; Riga et al., 2017). Studies have shown inquiry-based science instruction increases the value of science for young adolescents (Dorph et al., 2018; Giesige, 2017; Shumow & Schmidt, 2014), makes it exciting, and changes their outlook on their future (Dorph et al., 2018; Filgona et al., 2020; Scogin et al., 2017; Shumow & Schmidt, 2014). It contributes to student's noncognitive growth and accumulates over their years in school (Larmer, 2016; Scogin et al., 2017). As students become empowered, they grow and see the difference they can make with their contributions to a solution (Larmer, 2016). Students learn how to identify problems, ask the right questions, form an effective team, and find resources. By working through their own difficulties, students improve their problem-solving abilities unafraid to "fail forward" until they succeed (Darling-Hammond et al., 2020; Larmer, 2016, p. 69).

Science teachers should spend more time using inquiry-based instructional strategies in problem-solving contexts, and less time in didactic presentations of facts (Scogin et al., 2017). Through well-designed scaffolding, teachers guide students in their discovery of new learning (Darling-Hammond et al., 2020; Hmelo-Silver et al., 2007; Kuhlthau et al., 2015; Larmer, 2016; Marshall et al., 2017; Scogin, 2016). Teachers facilitate a collaborative learning environment providing just enough freedom for students to communicate and negotiate with each other, and support their developing analytical skills when interpreting information (Chu et al., 2017; Kuhlthau et al., 2015; Scogin, 2016). The assigned tasks are challenging yet manageable; with support provided in the form of questions, demonstrations, or the generation of hypotheses, the tasks are achievable.

According to the National Science Teachers Association (2003), "Teachers, regardless of the grade level, should promote inquiry-based instruction and provide classroom environments and experiences that facilitate students' learning of science" (p.

196). Research supports inquiry-based science instruction over traditional instruction for the transfer of learning to new contexts and increased achievement (Alfieri et al., 2011; Furtak et al., 2012); such research describes what science teaching should be if the nation is to reach its goal of achieving scientific literacy for all students.

Student engagement in inquiry-based science activities have been shown to increase critical thinking skills (Marshall et al., 2017), develop teamwork (Scogin, 2016), and contribute to higher order thinking skills (Darling-Hammond et al., 2020). Inquiry-based science instruction increases student conceptual knowledge, improves student achievement (Andrini, 2016; Marshall et al., 2017; Scogin et al., 2017), and plays a role in narrowing the achievement gap in science education (Giesige, 2017; NRC, 2012; National Science and Technology Council, 2018); confirming inquiry is beneficial for all learners. The best time to introduce students to these skills is during the formative middle school years (Bishop & Harrison, 2021; Cook et al., 2016; Riegle-Crumb et al., 2019). Middle school teachers who engage students in inquiry-based science instruction create an environment for young adolescents to become thinking, knowledgeable, responsible citizens with the potential to make great contributions on the global stage (Bowers, 2000).

Title I

At nearly $16 billion per year, Title I of the ESEA of 1965 is the largest federal government program targeted toward elementary and secondary education (U.S. Department of Education, 2019). The purpose of the program is to provide funding to schools with a student base from low-income families to help students who are behind or at risk of falling behind. The financial assistance to schools is used to close the achievement gap between high- and low-performing students, particularly achievement gaps between minority and non-minority students, and between economically disadvantaged students and their less economically impoverished peers (Paul, 2016). To be considered for Title I funds, a school must have at least 40% of its enrolled students designated as low-income (U.S. Department of Education, 2018). Approximately 90% of districts receiving Title I funds use data identifying children approved to receive free or reduced-price school meals for this purpose.

Title I funds, though used in a myriad of ways, were designed to supplement, not supplant, state and local funding to equalize spending between low-income and high-income districts. The policy aims to equalize education opportunities for students in our nation's highest poverty schools and includes high enrollment of limited English proficient students, migratory students, students with disabilities, Native American students, neglected or delinquent students, and young children in need of reading assistance (U.S. Department of Education, 2004). This goal has been the central theme of Title I since President Johnson's War on Poverty (Casalaspi, 2017; Nelson, 2016). President Johnson believed that without federal intervention, the educational needs of the poor and minority student would continue to be neglected by state and local policymakers.

The primary focus of Title I has always been to "ensure all children have a fair, equal, and significant opportunity to obtain high-quality education and reach, at a minimum, proficiency on challenging state academic achievement standards and state academic assessment" (U.S. Department of Education, 2004, Statement of Purpose section). Since 1965, when President Johnson signed ESEA into law, Title I has gone through many modifications while continuing to fund historically marginalized populations. In 2015, ESEA was reauthorized as Every Student Succeeds Act. Of the twelve goals presented within the reauthorization, ten are relevant to this study: (a) align state academic standards to instruction and accountability measures; (b) meet the educational needs of low-achieving children in the highest-poverty schools; (c) close the achievement gap between high and low performing children and disadvantaged children and their more advantaged peers; (d) hold schools and states accountable for improving achievement and providing alternatives for schools that do not; (e) distribute and target resources to meet the greatest needs; (f) use state assessment systems to ensure proper distribution of resources; (g) give greater decision-making authority to schools in return for higher accountability for achievement; (h) provide an enriched, accelerated educational program; (i) promote schoolwide reform based on scientifically-based instructional strategies and challenging academic content; and (j) offer evidence-based opportunities for professional development (U.S. Department of Education, 2004).

In 2017, Every Student Succeeds Act was updated with a renewed focus on comprehensive education for all students. Emphasis was placed on positive school climate, equity, student growth and achievement, principal professional development, and preparing students for college and careers (Soung Bae, 2018; U.S. Department of Education, 2017). Over time, Title I funding moved from resource allocation to fiscal compliance to a heightened concern for program excellence and student achievement on a school-wide model (Casalaspi, 2017; Nelson, 2016; Paul, 2016; U.S. Department of Education, 2017).

As a condition for receiving Title I funds, states must have a state plan delineating how their academic accountability system has adopted challenging content standards and aligned academic achievement standards in reading/language arts, mathematics, science and any other subject chosen by the state (U.S. Department of Education, 2017). The states must then annually measure the performance of all public school students using indicators based on the state's long-term goals (U.S. Department of Education, 2017). Results of the assessment of student achievement levels are reported to parents and the public. The results must reflect adequate yearly progress toward achieving the goals in the plan. A school that does not meet state goals for two consecutive years is subject to corrective measures from the district. The corrective actions include: replacing staff who are relevant to the failure to make AYP; instituting and fully implementing curriculum; providing appropriate professional development for appropriate staff; significantly decreasing management authority at the school level; appointing an outside expert to advise the school on its progress toward making AYP; extending the school year or school day for the school; or restructuring the internal organizational structure of the school (U.S. Department of Education, 2017).

ESEA and Title I were designed to be an equity bridge for disadvantaged students, nonetheless, academic achievement gaps still persist (Black, 2017; Darling-Hammond, 2018; Dotson & Foley, 2017; Duncan & Murnane, 2016; Garcia & Weiss, 2017; Hanushek, 2011; Hegedus, 2018; Michelmore & Dynarski, 2017; Suggs, 2017).

This gap reflects the extent to which the needs of students with low socioeconomic status are not met and therefore their talents are left unrealized (Garcia & Weiss, 2017). As the level of poverty increases, the level of academic achievement decreases (Dotson & Foley, 2017; Hegedus, 2018; Reardon, 2016a). Although socioeconomic status is a powerful force that can shape a student's educational opportunities and future success, it does not define their destiny. Every Student Succeeds Act calls for the use of evidence-based activities, strategies, and interventions to improve student achievement (U.S. Department of Education, 2017). Inquiry-based instruction is an evidence-based strategy that benefits all students regardless of socioeconomic status (Chu et al., 2017; Larmer, 2016; Marshall et al., 2017) and can serve to mitigate the impact of economic inequalities. Inquiry-based instruction offers better chances for students' career prospects and future life (Garcia & Weiss, 2017) and an equitable opportunity to achieve the American dream.

Challenges of Implementing Inquiry-Based Science Instruction

Schwab (1958) identified four reasons why teachers cling to the didactic presentation of facts: time consumption, confusion due to the complexity of inquiry, job requirements, and economics. Although inquiry approaches have been encouraged for over 50 years, classroom instruction is generally still teacher-centered and textbook based, with Schwab's reasons still resonating today. Despite the fact that teachers know the importance of inquiry-based science instruction, the barriers that impinge on their ability to consistently apply it in their classroom include time limitations, lack of supplies and materials, the caseload of selected topics in the standards, and the limited background of students' knowledge (Dailey & Robinson, 2016; Eltanahy & Forawi, 2019; Keiler, 2018).

Schools of poverty are characterized by populations of at least 40% of students from low-income families (U.S. Department of Education, 2018). Title I is a federal education program created to ensure all children have an equitable opportunity to obtain a high-quality education and reach proficiency on standardized state assessments. In addition to the challenges experienced in non-Title I schools, schools of poverty must deal with the cumulative pressures of curriculum completion, classroom management, accountability, teacher quality, and retention rates putting students at a disadvantage for achievement (Hirn et al., 2018; Morgan et al., 2016). Schools with a high incidence of poverty and ineffective teachers were less likely to make available inquiry-based science instruction thereby affecting student academic achievement in science and their academic trajectory (Ames et al., 2020). In Title I schools, poverty shapes how students are treated and how they respond to instruction (Jensen, 2013; Reardon, 2016a). The result is a consistent achievement gap for students with lower socioeconomic status (Darling-Hammond, 2014; Duncan & Murnane, 2016; Reardon, 2016b).

Teacher Knowledge and Beliefs About Inquiry

The use of inquiry-based instruction in the science classroom provides the inventive activities middle school educators can focus on to meet the required written and oral communication skills, critical thinking skills, ability to apply knowledge, teamwork skills, and ethical decision-making skills for STEM related careers (NRC, 2000). Teachers know the importance of using inquiry-based science instruction for student engagement and making content relevant to students (DiBiase & McDonald, 2015; Eltanahy & Forawi, 2019; Fitzgerald et al., 2019). However, science teachers face the difficulty of planning, scaffolding for differentiation, monitoring, and modeling inquiry-based science instruction (Alston et al., 2020; DiCicco et al., 2016). Self-related concerns regarding lack of science content and pedagogical knowledge, and low teaching confidence (Dailey & Robinson, 2016; DiBiase & McDonald, 2015) are barriers for implementing inquiry-based science in the classroom.

When teachers believe it is difficult to implement inquiry-based science instruction on a consistent and regular basis, they default to teacher-centered instruction to directly mirror high-stakes measures of accountability (DiBiase & McDonald, 2015; DiCicco et al., 2016; Marshall et al., 2017). Teachers believe the time needed to implement inquiry-based science instruction takes away from teaching the content required by assessment standards. Shifting the teaching paradigm from teacher-centered to student-centered can be difficult for teachers as they transition to being a facilitator of learning (Alston et al., 2020; Dailey & Robinson, 2016; Hong & Vargas, 2016; Keiler, 2018). Contradictions to this shift are an indication of teachers' acceptance and readiness to implement change (Dailey & Robinson, 2016). For instructional practices to change, science teachers must believe that a need to change exists; they must have multiple opportunities to see and practice inquiry-based science instruction (Marshall & Alston, 2014).

Teacher apprehension to change can be remedied with professional development to improve science teachers' pedagogical content knowledge and enhance their teaching skills in implementing effective inquiry (Eltanahy & Forawi, 2019; Fitzgerald et al., 2019; Marshall et al., 2017). Teacher focus on task-related concerns diminishes with extensive support in the form of professional development (Dailey & Robinson, 2016). Blanchard et al. (2013) posited, and Fitzgerald et al. (2016) confirmed that science teachers are more likely to use inquiry-based instruction consistently if they are comfortable with a clear model of inquiry that meets science standards, allows for teacher reflection, and fits into the existing curriculum, timeframes, and other school environmental factors implemented by leadership. Science teachers want to make a difference in students' lives, but they need the knowledge and tools to do it. Ongoing support with effective feedback allows teachers to scaffold from their own instructional approach to inquiry-based science instructional practices (Marshall & Alston, 2014). Professional development interventions sustained over time transforms into effective inquiry-based science instructional practices thereby increasing student understanding of science knowledge and scientific practices (Marshall et al., 2017).

Accountability Factors

The current accountability pressures created by the focus on student achievement and measured by high-stakes assessments threatens the use of inquiry-based science instruction (DiCicco et al., 2016; Farvis & Hay, 2020; Fitzgerald et al., 2019; Marshall et al., 2017; Mehta, 2020; NRC, 2012; Scogin et al., 2017). Standardized testing in Title I schools is the primary mechanism for measuring success and determining funding (Hegedus, 2018; Scogin et al., 2017; U.S. Department of Education, 2018). Schools and classroom environments are affected by the pressures of standardized testing (McNeill et al., 2016; H. Morgan, 2016). State academic standards and academic assessments that impact Title I eligibility undermine effective instructional change as teachers are challenged with aligning inquiry-based science instruction with standardized assessments. These high-stakes assessments are the cause of anxiety for educators and the Title I schools in which they work because of the fear of not meeting Title I AYP (Dotson & Foley, 2017; Farvis & Hay, 2020; Hegedus, 2018; Marshall et al., 2017). Their hard work with historically marginalized students is weighted heavily for achievement and not growth. Therefore, excellent growth may not be enough to prevent escalating sanctions including (a) restructuring, (b) turning the operations over to a private company, or (c) reopening the school as a privately operated charter (Hegedus, 2018; U.S. Department of Education, 2018). In this environment, the future resources of Title I schools are negatively impacted by the academic performance of their students (Ames et al., 2020); uncertainty, isolation and in-effective school operation are fostered as more resources are devoted to reconfiguring operations to maximize student test scores (Natriello, 2009). A cycle of inequality is perpetuated as the limited capability to attract quality resources generates further inequality at the expense of a broad curriculum (Ames et al., 2020; Farvis & Hay, 2020).

Schools and districts serving more advantaged students are more likely to meet the standards of assessments. Non-Title I schools, comprised of predominantly middle-income and wealthy students, are awarded with additional funding while supplementary financial resources are allocated to lower performing schools (Black, 2017). To achieve their potential, Title I students require more resources than their peers. Because of the pressure to improve scores in a Title I environment where economic struggle is the rule and financial stability is the exception (Darling-Hammond, 2018), science teachers will sacrifice higher-level thinking skills for rote learning in the science classroom (H. Morgan, 2016). There is a replacement of the individualization, differentiation and customization of inquiry-based science instruction valued by the Every Student Succeeds Act and Title I (U.S. Department of Education, 2017) for a ‘Test Prep’ instructional model in the science classroom (Farvis & Hay, 2020). It is counterintuitive and counterproductive to the widely accepted conceptual and analytical learning process (Dotson & Foley, 2017; Farvis & Hay, 2020).

The unintended consequences of standardized assessment testing are the concentrated efforts by schools on instructional activities designed to maximize student performance on the test and the abandonment of others including inquiry-based learning (Marshak, 2003). Curriculum and instruction are narrowed and fragmented into test-related topics (Au, 2007; Morgan, 2016), and instructional time for non-tested subjects receive less attention and fewer resources (Goertz & Duffy, 2003). These consequences do not fall equally on all types of schools; Title I schools with greater challenges in bringing student achievement to acceptable levels are more likely to experience these consequences.

Retention of Quality Science Teachers

Researchers have documented that a strong relationship exists between teacher quality and student achievement (Ames et al., 2020; Farvis & Hay, 2020; Goldhaber, 2016; Hanushek, 2011; Kini & Podolsky, 2016; NRC, 2012). Review of research within the last 15 years found that as teachers gain experience in the classroom, their effectiveness improves (Kini & Podolsky, 2016). That effectiveness is seen in student achievement gains and better school attendance. When all students are provided with similar learning opportunities with qualified science teachers, the use of high-stakes assessments becomes an acceptable measure of success (NRC, 2012). This approach assumes that as students progress through grade levels, the cumulative impact of quality science teachers is consistent, producing positive student achievement gains and long-term outlooks (Ames et al., 2020; Darling-Hammond et al., 2020; Goldhaber, 2016).

The demand for highly qualified science teachers is challenging in most states across the nation, especially in schools serving low-income families (Carver-Thomas & Darling-Hammond, 2017; Farvis & Hay, 2020; Geiger & Pivovarova, 2018; Luft et al., 2020; Taylor et al., 2020). The supply and demand problems are attributed to teacher turnover. Although several factors affect teacher attrition, this review will focus on teacher attrition due to workplace conditions in Title I schools. High mobility rates undermine Title I school inquiry-based science instruction efforts in a perpetual challenge to recruit new science teachers each year (Farvis & Hay, 2020). The science teacher turnover rate in Title I schools is nearly 70% greater than in non-Title I schools (Carver-Thomas & Darling-Hammond, 2017). Turnover affects students as schools respond by hiring unqualified or inexperienced science teachers (Sutcher et al., 2019) who are less able to provide instruction required in Title I schools (Farvis & Hay, 2020).

There is a prevalence of out-of-field (OoF) science teaching because vacant positions are filled with teachers outside of their area of expertise (Luft et al., 2020;

Taylor et al., 2020). OoF teaching occurs more frequently in Title I middle schools and has a negative relationship with science achievement (Carver-Thomas & Darling-Hammond, 2017; Taylor et al., 2020). It is pervasive in middle schools with 88% of classes being taught by OoF teachers (Taylor et al., 2020). OoF teachers in classes without the adequate knowledge to facilitate inquiry-based science instruction are less likely to provide students with effective learning experiences (Luft et al., 2020; Sutcher et al., 2019). Unqualified teachers (Ames et al., 2020; Kini & Podolsky, 2016) and teacher attrition (Geiger & Pivovarova, 2018; Kini & Podolsky, 2016; Luft et al., 2020; Taylor et al., 2020) negatively impact inquiry-based science instruction, and put Title I middle school students at an educational disadvantage. In contrast, qualified teachers given the opportunity to consistently teach inquiry-based science increase in confidence and instructional efficacy (Kini & Podolsky, 2016).

Inquiry-based science instruction practices require teachers to modify the way they teach and interact with their students and is not a simple task (Hong & Vargas, 2016). Lack of administrator support is most predictive of science teacher attrition; teachers struggle to manage the change from a traditional classroom to an inquiry-based science classroom (Carver-Thomas & Darling-Hammond, 2017). How a science teacher perceives the ability of their school administration to encourage and acknowledge them, communicate a clear vision, and generally manage a school will influence their decision to stay or leave a Title I school. Opportunities for quality professional development and mentoring support mitigates science teacher attrition in Title I middle schools (Geiger & Pivovarova, 2018). Effectively retaining well-prepared and committed science teachers confers positive benefits to Title I schools and their students (Carver-Thomas & Darling-Hammond, 2017). Teachers pleased with their workplace conditions are more likely to increase student academic achievement and improve school climate.

Environmental Factors

Science teachers in Title I middle schools are faced with several environmental factors that make implementing inquiry-based science instruction difficult (Dailey & Robinson, 2016; DiCicco et al., 2016). Task-related concerns of time constraints for instruction and preparation (Dailey & Robinson, 2016; Fitzgerald et al., 2019; Hong & Vargas, 2016), and lack of availability of resources to conduct scientific investigation to create learning experiences that can positively affect instruction (Dailey & Robinson, 2016; DiCicco et al., 2016; Fitzgerald et al., 2019; Hong & Vargas, 2016) are frequently mentioned by science teachers as barriers to effectively implementing inquiry-based science instruction. Title I students' low cognitive abilities, students' lack of effort, and students' disruptive behaviors (DiBiase & McDonald, 2015; DiCicco et al., 2016; Hong & Vargas, 2016) also influence the implementation of inquiry-based science instruction and experiences. When science teachers are provided professional development, what is learned generally gets pushed aside by more urgent concerns in the Title I classroom (Fitzgerald et al., 2019). The pedagogical process of transforming what is learned in professional development workshops into inquiry-based science instruction practiced in the classroom is lost to the constraints of time. For these teachers, stress is created by long hours, rapid professional decision-making involving simultaneous problems, being pulled in multiple directions, and the residue of expectations after class is over (Beck, 2018). Their attention is diverted from facilitating inquiry-based science learning experiences for their students; they are left feeling inadequate and may leave the profession.

Role of Administrators and Teachers in Title I Middle Schools for Curriculum Reform

The demand for improved science education challenges teachers, administrators, and school districts to add quality science instruction to their already full day (Dailey & Robinson, 2016). As the bridge between high school and elementary school, middle schools play a primary role in student achievement (Bishop & Harrison, 2021; Santamaría & Santamaría, 2013; Taylor et al., 2020). The learning environment for middle schools provides opportunities to interact and learn in a safe environment (Vincent, 1996). In middle schools, a theme of collaboration among students and teachers exists, along with attention to adolescent learning (Bishop & Harrison, 2021; Scogin et al., 2017). In this evolving landscape of innovation, middle school principals must have a vision that aligns with the technological innovation requirements of STEM to support economic growth (Andrini, 2016; Chu et al., 2017; Rothwell, 2013). Preparing students in science or technology fields is more important than ever; transformational leaders must guide educators to develop and implement instructional strategies and establish a school climate that is conducive to student achievement (Gurr et al., 2010; Larmer, 2016; National Science and Technology Council, 2018; Scogin, 2016).

Title I principals are required to develop school improvement policies and practices that support state academic standards and academic assessments to demonstrate

AYP. Often, school leaders focus on navigating through external district and state accountability policies for academic achievement while attempting to negotiate internal policies for inquiry-based science instruction (Baptiste, 2019; Hitt & Meyers, 2018; Keiler, 2018; Koyama, 2014). Title I schools are less likely to make available inquiry-based science instruction. Science teachers must choose between using familiar instructional methods or implementing inquiry-based instruction when faced with teaching an extensive amount of curriculum for mandatory assessments (DiBiase & McDonald, 2015; DiCicco et al., 2016; Marshall et al., 2017). As a result, science achievement may not be maximized, and students may be unprepared for an economy that is seeking STEM skills.

According to Farvis and Hay (2020), teachers feel ineffective because they have less time to incorporate student-centered activities while coping with increased pressure to teach in a traditional fact-based method to prepare students for standardized tests. Furthermore, principals feel innovative methods of instruction are not supported because testing policies drive instruction; instruction aligns with teaching to the test, an environment in which instruction focuses on items that appear more frequently on standardized tests. This measurement of student success as assessed by state accountability systems is driven by Title I accountability systems (U.S. Department of Education, 2018). The Title I, Part A requirement for 2-year data trends show academic achievement leads to an environment of high anxiety for students and educators. (Brown & Hattie, 2012). Facing the cumulative pressures of curriculum completion, classroom management, and accountability, science teachers often must choose between implementing inquiry-based instruction and traditional methods (NRC, 2012). The unintended consequences of ineffective teaching include a narrowing of the curriculum and an increase in cheating (Brown & Hattie, 2012; H. Morgan, 2016).

Nonetheless, empirical evidence shows inquiry-based learning can foster meaningful understanding of concepts and cause positive gains in standardized assessment scores; teachers can foster inquiry in the classroom and provide inquiry opportunities for students (Darling-Hammond et al., 2020; Dorph et al., 2018; Giesige, 2017; Scogin, 2016; Shumow & Schmidt, 2014). Principals must actively negotiate their support and implementation of Title I accountability measures, while maintaining commitments to teachers and their own vision of inquiry-based science instruction (Baptiste, 2019; Gordon et al., 2006; Hitt & Meyers, 2018; Koyama, 2014). Demonstrating their commitment to inquiry-based science instruction, principals should acquire the needed materials for science investigations, and provide teachers with sustained professional development that focuses on content knowledge, pedagogical skills, and confidence in teaching science.

Summary

The purpose of this literature review is to provide background to frame my study that seeks to explore and gain an understanding of Title I middle school teacher and principal perspectives on and experiences of inquiry-based instruction in the science classroom within the framework of Title I requirements. The review outlined the NRC Framework for K-12 Science Education, the developmentally responsive middle school and the construct of Title I for the benefit of equal access to a quality education. The review focused on aspects of inquiry-based learning and factors that affect its implementation. Synthesis of the literature supports the inclusion of educator's input and experiences, consideration of educators' needs within a school, and a more proactive view of educator's beliefs when implementing inquiry-based instruction in the Title I science classroom. A gap exists in the literature in the exploration of Title I middle school teacher and principal perspectives on and experiences of inquiry-based instruction in the science classroom within the framework of Title I requirements. By exploring teachers' and principals' perspectives, I sought to fill a portion of the literature gap by analyzing whether existing policies and available school and classroom support within a Title I middle school impedes or supports inquiry-based science pedagogy, the cultivation of skills of investigation, and an understanding of scientific inquiry. Knowledge in the discipline may provide evidence of the delivery of inquiry-based science instruction within a Title I middle school learning environment and its contribution to effective teaching practices.

In Chapter 3, I address the study design and rationale for selecting a basic qualitative study. I specify the study population, sampling, data collection, and data analysis procedures. The methodology described in Chapter 3 is consistent with that of qualitative studies which seek to interpret participant perceptions.

Chapter 3: Research Method

Introduction

Effective science teaching has been aligned for decades with the use of an inquiry-based approach to learning (American Association for the Advancement of Science, 1993; NRC, 1996, 2000). Inquiry-based instruction is recognized as a bridge for connecting ideas to coherent learning experiences and as a means to actively engage students in learning science (American Association for the Advancement of Science, 1993; Crowell & Schunn, 2016; Darling-Hammond et al., 2020; Larmer, 2016; National Academies of Sciences, Engineering, and Medicine, 2016; NRC, 1996, 2012; Scogin et al., 2017). The purpose of this basic qualitative study was to explore Title I middle school teacher and principal perspectives on and experiences with the challenges of delivering inquiry-based science instruction within the framework of Title I requirements. The findings may inform effective practices and actions that academic leaders can consider to increase the use of inquiry-based science instruction in Title I middle schools.

This chapter provides a description and rationale for using the basic qualitative study method to interpret teachers' and principals' experiences. I explain the research design and rationale. This chapter contains an explanation for using qualitative rather that quantitative methods of inquiry and a description of the basic qualitative study method with an explanation of why the basic qualitative method was appropriate for this study. I also provide the research questions, participant selection description, the role of the researcher in the context of the study, the justification of the instruments for collecting data, and the plan for data collection. In the data analysis plan, I explain the process of interpreting and analyzing data. Finally, this chapter concludes with an assessment of issues of trustworthiness and ethical procedures.

Research Design and Rationale

Three research questions were central to gathering study data:

RQ1: What are the perspectives on and experiences with inquiry-based instruction within the framework of Title I requirements of science teachers in a Title I middle school?

RQ2: What are the perspectives and experiences of Title I middle school principals regarding the challenges to the successful delivery of inquiry-based science instruction within the framework of Title I requirements?

RQ3: How do Title I middle school policies and practices impact the delivery of inquiry-based science instruction within the framework of Title I requirements?

The central phenomenon of interest was teachers' and principals' perceptions of inquiry-based science instruction in Title I schools. The NRC's concept of actively engaging K–12 students in scientific practices (NRC, 2012) and Title I requirements (U.S. Department of Education, 2018) were used to analyze teacher and principal responses concerning their inquiry-based science instruction perceptions within the framework of Title I requirements.

In this study, I used a basic qualitative methodology. The goal of this study was to explore and understand teacher and principal perspectives on the challenges of delivering inquiry-based science instruction in the framework of Title I requirements. Qualitative interviewing helped me accomplish this goal. According to (Rubin & Rubin, 2012), qualitative interviewing is based on conversations in which a researcher engages in asking questions and listening to interviewees' responses with the objective of acquiring participants' experiences as opposed to discovering facts. I chose this method of research to allow teachers and principals to articulate their perceptions.

Although remaining rigorous in its application, basic qualitative studies offer researchers flexibility not commonly found in the rigid boundaries of traditional research methods (Creswell & Creswell, 2019). Because of the flexibility and potential of basic studies to draw upon strengths of established methodologies, Merriam and Tisdell (2016) supported this approach as a stand-alone method of study. Researchers using this approach can customize or develop a research design tailored to their epistemological position and particular research questions (Creswell & Creswell, 2019), that can result in descriptions or interpretations collected via interviews that may, through analysis, depict experiences of study participants.

Researchers use a quantitative approach to observe and measure numerical data for the purpose of statistical data quantification (Ravitch & Carl, 2016). The qualitative approach is often selected because qualitative researchers study real-world situations; adapt to changes in situations and understandings; and provide deeper and richer understandings of complex phenomena, perceptions, and individual voices (Patton, 2015). In contrast to taking a quantitative approach, a qualitative scholar seeks to ascertain the perceptions of the participants as opposed to testing variables (Babbie, 2017) or accumulating numerical data. Understanding and exploring teachers' perceptions cannot be measured numerically.

An interview-based study design allows participants to express their experiences through conversation. I chose to construct a basic qualitative study because my interest was in how teachers perceive inquiry-based science instruction within the framework of Title I requirements and the meanings they attribute to those experiences. A basic qualitative approach is appropriate when thoughtful descriptions of people's experiences are the desired outcome (Percy et al., 2015). In this study, I was interested in people's interpretations of their experiences, constructions of their worlds, and the meanings attributed to their experiences. Therefore, a qualitative study design was a sound choice (see Merriam & Tisdell, 2016). Using data collected through interviews allows teachers' and principals' voices and experiences to emerge and the rich descriptions of their experiences to be conveyed.

I considered other study approaches but did not select them. According to Merriam and Tisdell (2016), "a phenomenological approach is well-suited for studying affective, emotional, and often intense human experiences" (p. 26). A phenomenological study provides a description of the essence or underlying structure of a phenomenon (Patton, 2015). I chose not to select this approach to allow for more descriptive data about the participants' experiences with inquiry-based science instruction within a Title I framework rather than conducting an in-depth analysis of how they experience themselves as teachers and principals.

Scholars use case study designs to describe cases with limited structures over a defined or bound time period common to all participants and involve multiple sources of data, observations, interviews, and document analysis (Creswell & Creswell, 2019). I did not choose this approach because the study is not bound to a population or cultural group. Data would not be collected from multiple sources, and observations would not be made. Thus, qualitative interviews were deemed best suited for the goal of this study.

I did not select grounded theory because my goal was not to generate a theory based on the analysis of participants' experiences. Grounded theory studies typically necessitate many interviews. For this study, each participant was interviewed once with follow-up interviews and member checking as needed. An ethnographic approach explores and describes participant language, beliefs, and behaviors from a cultural point of view (Ravitch & Carl, 2016). I did not select this approach because it was not the intent of this study to present findings from a cultural perspective. Ethnographic studies are focused on interviews and field observations over extended periods of time. I collected data for this study through in-depth interviews, which revealed the experiences of the participants. Accordingly, I chose the basic qualitative approach, deeming it most appropriate for the purpose of this study.

Role of the Researcher

As the exclusive investigator, I was the only individual with direct interactions with the participants. I gathered the information, transcribed the interviews, and interpreted the data. The participants in this study were sixth through eighth grade middle school teachers and their principals who work at nine different campuses within a 10-mile radius of each other in the same district in the southeastern United States. I did not work at any of the sites. No conflict of interest, supervisory issues, or power differentials existed. My potential researcher bias derives from working in the same district and the fact that I may have attended professional development trainings with the participants. I addressed this bias through member checking and other means defined in the trustworthiness section.

Potential researcher bias for the use of inquiry-based science instruction did not influence the perspectives of the participants; the voices of the participants were faithfully represented. I addressed this bias by returning the transcripts of interviews to participants to verify the accuracy of their narratives. Additionally, participants were told they may withdraw from the study at any time with no repercussions, and confidentiality of participants was guaranteed. Incentives to participate in the study were not provided.

Methodology

Participant Selection Criteria

The population for this study comprised 11 teachers and two principals who work at nine middle schools within a 10-mile radius of one another. The nine schools are located in one southeastern school district that encompasses suburban regions and serves pre-K through 12th grade student populations that exceed 102,000 students. The schools are Title I schools and are characterized as high poverty schools. According to the National Center for Education Statistics (2012), high-poverty schools are defined as public schools where more than 75% of the students are eligible for the free and reduced-price lunch program.

The nine schools service similar student populations, and the staff of the nine schools are often geographically grouped together for district professional development training. The participants in the study work in Title I schools and are fully credentialed. I determined the number of participants by identifying a saturation point when interview responses became redundant. According to Rubin and Rubin (2012), the sample size of a qualitative study is predicated on the objectives and nature of the study.

I used purposive sampling for this study. Purposive sampling involves the selection of participants based on common characteristics and the objective of the study (Babbie, 2017). Patton (2015) posited that purposeful sampling of information-rich sources is used so that the greatest amount can be learned about an issue. Participants were full-time teachers, had a minimum of 5 years teaching experience, and attended district-directed professional development for inquiry-based science instruction. In the event teachers with 5 years' teaching experience did not respond, I invited teachers with a minimum of 3 years' teaching experience to participate as a contingency. This contingency improved the feasibility of the study and allowed me to acquire a sufficient number of participants.

As I sought to understand the perspectives of participants and shape meaning from their experiences, it was important that the participants who volunteered for this study had actual experiences (Creswell & Creswell, 2019). Therefore, I planned to interview 10 to 12 sixth through eighth grade teachers and two principals; students in these grade levels take state assessments in science. Twelve participants would represent about one third of the available sample. According to Babbie (2017), the sample size used should provide the best opportunity for a researcher to reach data saturation. Specifying the number of qualitative interviews needed was difficult; therefore, I conducted interviews until I identified saturation. Patton (2015) advised selecting a sample size based on the reasonableness of describing a phenomenon with a selected number of participants. Given that saturation may be difficult to prove, the goal of qualitative research is to make meaning of experiences rather than provide generalized statements; thus, the number of participants reflects various viewpoints and experiences and is based on the scope of the study (Babbie, 2017).

Instrumentation

I gathered study data through interviews. The protocol outlining the procedures for interviews is found in Appendix A. I used open-ended interview questions to collect data to respond to the research questions. To ensure alignment with the purpose of the study, three experts not associated with the study vetted the interview protocol. According to Creswell and Creswell (2019), using experts as peer debriefers to review and ask questions about the interview protocol adds validity to the study. The committee of experts had terminal degrees in education and their feedback on the interview protocol confirmed it was researcher developed, informed by the purpose of the study, and would garner the information needed to address the research questions.

I collected data through audio recorded interviews and note taking. The notes included nonverbal cues and body language observed during interviews. Each interview occurred via teleconference at a time and in a location convenient to the participant. I recorded each interview to ensure accuracy and transcribed the recordings later. I anticipated the interview lengths would range from 45 to 60 minutes.

Using open-ended questions, I led the interviews with the intent of capturing teachers' and principals' experiences, thoughts, interpretations, and perceptions.

Attaining qualitative data via interviews is appropriate for qualitative studies (Creswell & Creswell, 2019; Yin, 2013). Member checking allowed the participants to review the transcripts and to comment on my interpretations of their responses. I scheduled follow-up interviews as needed to provide clarification of original data and to allow the interviewee to add to their response after reviewing their emailed transcript. This step allowed me to make corrections or clarifications.

Data Analysis Plan

Using constant comparison, I analyzed data for this study as it was collected. Merriam and Tisdell (2016) posited that data analysis commences after the first interview and is continuous throughout the study. I analyzed data holistically after all interviews were concluded to allow common patterns to emerge (Creswell & Creswell, 2019; Patton, 2015). Constant comparison is a form of inductive analysis used in qualitative studies (Percy et al., 2015). I used member checking during the data collection process as needed for clarification and to respond to emerging or follow-up questions. Upon the completion of interviews, I analyzed the responses to determine common words, phrases, or sentences for open coding. Open coding allowed me to identify reoccurring words for labeling and defining concepts that emerged from the data (Saldana, 2016). Axial coding further synthesized and clustered the information obtained from the interviews. Axial coding consists of identifying relationships among the concepts, categories, or themes that emerge during the open coding (Ravitch & Carl, 2016).

As interviews occurred, I transcribed the recorded responses using voice-to-text software. Computer software applications allowed digital recordings to be downloaded;

and the use of a voice-to-text feature produced a transcription of the recording. Engaging in continuous coding as data were obtained, I entered the data into a table used to organize and code the data. According to Saldana (2016), computer aided analysis is more thorough, methodical, and thus frees the researcher from manual tasks allowing the researcher to then concentrate on the data. Budgetary and time constraints precluded the use of data analysis software. Given the interview sample size, using a chart to code and analyze the data was sufficient.

Issues of Trustworthiness

I established the credibility of this study using member checking. As I transcribed interview data, participants received a copy of the transcription via email for review and clarification. Use of member checking provided a means to ensure the study was ethically conducted and the findings are trustworthy, valid, and reliable. I used member checking if specific questions arose that required additional information. Additionally, I reinforced the dependability of the study by using reflexivity, maintaining an audit trail, and member checking. I maintained a research journal describing my own experiences and biases that may have influenced my interpretation of the data (Merriam & Tisdell, 2016) and engaged in self-monitoring to ensure alternate explanations were considered. I created an audit trail to provide a detailed account of the research process and how I arrived at data conclusions. In addition, during interviews, I refrained from adding my personal comments and recorded those thoughts in my journal.

I addressed transferability by providing rich descriptions of the study's procedures, context, participants, and their experiences at a level of detail that permitted others in similar situations to arrive at similar conclusions. Confirmability is related to a qualitative study's objectivity. For this study, I addressed confirmability through use of reflexivity by engaging in self-reflection for the purpose of identifying factors that may have influenced my interpretation of the data (Merriam & Tisdell, 2016). Additionally, I used a journal to reflect upon my own experiences with inquiry-based science instruction in a Title I framework.

Ethical Procedures

Upon acquiring approval (# 01-13-22-0637329) from Walden's Institutional Review Board (IRB) to conduct this study, I contacted and invited potential participants at each school by email. As they indicated a willingness to participate, participants received a consent form detailing the purpose of the study, expected duration of the study, expectations of the participants, the voluntary nature of the study and their right to withdraw from the study at any time, methods of data collection requested, choice of an interview time that was convenient to them, and assurance of confidentiality of all identifying information and ethical protection. The consent form included information about member checking and how participants may review any material related to the study. I provided study information and requested informed consent via email. Interested participants who wished to participate responded to the email with the response of "I consent".

I was solely responsible for each phase of this study, for ensuring confidentiality, and for maintaining the anonymity of the participants. I explained the purpose of the study and answered any questions potential participants had. After collecting the data, I secured it in a locked file cabinet in my home. Documents containing transcript responses were encrypted and password protected. I transcribed the data in my home where all identifying information will be kept confidential in a locked file cabinet. I used pseudonyms for all participant information to ensure confidentiality. I used fictitious names to present the data in Chapter 4. I will retain information for five years at which time it will be destroyed.

Summary

In this chapter I provide an explanation of the decision to use a basic qualitative study as the best research methodology for exploring and gaining an understanding of Title I middle school teacher and principal perspectives on and experiences of inquiry-based instruction in the science classroom or districts, current use of inquiry-based science instruction in Title I schools, and interest in using inquiry-based science instruction in Title I schools. I explain the reasons for selecting this methodology as the most appropriate for addressing the problem and the research questions. I describe each component of the research design for this study, the anticipated participants, setting of the research, data collection instruments, and participant selection. I outline the data analysis inductive steps used for analyzing the data, present procedures for ensuring the highest ethical standards, and provide criteria for trustworthiness of the study.

Chapter 4: Presentation and Analysis of Results

Introduction

The purpose of this basic qualitative study was to explore Title I middle school teacher and principal perspectives on and experiences with the challenges of delivering inquiry-based science instruction within the framework of Title I requirements. The findings may inform effective practices and actions that academic leaders might consider to increase the use of inquiry-based science instruction in Title I middle schools. Chapter 4 begins with a review of the research questions, descriptions of the interview settings and participant demographics, the data collection and analysis process, the evidence of trustworthiness, and the results of this qualitative study. The research questions that informed the methodology for my study are:

RQ1: What are the perspectives on and experiences with inquiry-based instruction within the framework of Title I requirements of science teachers in a Title I middle school?

RQ2: What are the perspectives and experiences of Title I middle school principals regarding the challenges to the successful delivery of inquiry-based science instruction within the framework of Title I requirements?

RQ3: How do Title I middle school policies and practices impact the delivery of inquiry-based science instruction within the framework of Title I requirements?

The research questions align with understanding, explaining, and describing the phenomenon of my research study and are informed by the conceptual framework of the study (Burkholder et al., 2016; Ravitch & Carl, 2016).

Setting

The data for this qualitative study were gathered through individual, open-ended, semi structured, teleconferencing interviews. In-depth qualitative interviews offer a researcher detailed information that includes examples, experiences, and stories from the participants' perspectives (Rubin & Rubin, 2012). The participants were allowed to respond as they chose and extend their responses while guided by a researcher using interview prompts as needed.

Thirteen participants made up the final study. Eight Title I middle school science teachers and principals from a southeastern school district that encompasses suburban regions and serves pre-K through 12th grade student populations exceeding 102,000 students met the initial criteria for the study. The criteria for selection of participants consisted of credentialed, full-time middle school principals and science teachers in two schools designated as Title I within a 10-mile radius of one another, with a minimum of 5 years of teaching experience. Participants attended district-directed professional development for inquiry-based science instruction. To improve the feasibility of the study, the study invitation was extended to science teachers at seven additional Title I middle schools within a 10-mile radius, and with a minimum of 3 years' teaching experience. An additional five Title I middle school science teachers met the modified criteria for the study.

Demographics

Of the 13 participants, four held bachelor's degrees, six held master's degrees and three earned a doctorate. Of the participants, seven were male and six were female.

Eleven participants were African American and two were Caucasian. Participants have held careers in education between 3 and 22 years, with the average being 8.38 years.

Data Collection

In this qualitative study, I conducted 13 teleconferencing interviews with principals and teachers who met the criteria for the study. The purpose of the interviews was to collect and analyze principals' and teachers' responses to interview questions. Upon IRB approval (#01-13-22-0637329), I received permission from the school district's IRB and permission to use internal systemwide data to inform the selection of participants for the study.

After identifying the Title I middle schools on the school district website, I randomly selected two schools within a 10-mile radius of each other. I then used the school staff websites to identify the science teachers and principals. I began collecting data by inviting 19 participants from the two schools using my Walden University email account and sending invitations to principals and teachers using their school email addresses on the school district's public website. The email invitation was the letter of consent for the study. The letter of consent included an introduction to the study, interview procedures, the voluntary nature of the study, any potential risks and benefits, and information about confidentiality. In addition, the consent letter indicated an email reply stating consent would be obtained before the interview.

Initially, a total of six teachers and two principals agreed to participate in the study and sent a reply email indicating they consented to participate. I replied to each principal and teacher to schedule a time for the teleconferencing interview that was convenient for them. A total of 13 teachers were unresponsive. I sent a second email invitation to the unresponsive teachers, but none replied to my invitation. Of the six teachers who agreed to participate in the study, three offered to enlist the help of other teachers. Their efforts yielded five additional teachers who met the expanded study criteria. With each consent to participate, I replied to each teacher to schedule a time for the virtual interview that was convenient for them. Saturation determined the number of participants for this study. According to Babbie (2017), the number of participants should reflect various viewpoints and experiences to make a meaningful statement. Using constant comparison, I saw common sentiments arise by the 10th interview. The 11th interview was held to see if any new data would surface. The data obtained from this last teacher interview were in line with the previous interviews. The 12th and 13th interviews were held to collect data from principals.

I conducted teleconferencing interviews with 13 participants to obtain the data for this study. At the beginning of each interview, each participant agreed for the interview to be recorded. I informed each participant that their identity would be protected. To protect the identity of participants, I labeled each transcript with a T, representing *teacher*, followed by a number, for example, T1, T2, etc., or a P, representing *principal*, followed by a number, for example, P1 and P2.

I interviewed 13 teachers and principals using an interview guide I created consisting of nine open-ended questions aligned with the three research questions for the study with follow-up prompts as needed (Appendix A). The interview guide supported the construct of a semi structured interview format designed with a series of questions that answer the research questions in alignment with the study's conceptual framework. As a characteristic of semi structured interviews, a set of follow-up questions were applied to gain specific examples or extend participants' responses (Patton, 2015).

All data were gathered through one-on-one interviews in a location and at a time convenient to each participating teacher and principal. A total of 10 participants chose their classroom, two participants chose their office, and one participant chose their home. All participants maintained the privacy of the interview by keeping their door closed. We engaged in light conversation about how they were doing, their day, their year, and their classes as ice breakers before the interviews began. Each teacher and principal appeared to be at ease, comfortable, and interested in participating. Nothing surfaced from the ice breaker conversations to indicate pressure or tension that could possibly influence the responses to the interview questions. All 13 interviews were completed over a period of two and a half weeks. Each participant was interviewed once.

With participant permission, the interviews were recorded using a video conferencing system that transcribed the interviews to text. The audio recording playbacks were clear and transferring the digital files to the computer was seamless. I converted each text transcription into a Word document. I took notes during each interview while following the interview guide to maintain consistency for each interview. No unusual circumstances were encountered during the data collection process. The final step in data collection was sending transcripts to each of the participants. Two teachers responded with minor corrections, and one teacher provided additional information to better explain one of their original responses.

Data Analysis

According to Ravitch and Carl (2016), quantitative data analysis must focus intensely on what participants communicate within their unique context and life experiences. With this requirement, I started my data analysis by printing out paper copies of each transcript and assigning each transcript a letter, *T* or *P*, followed by a number to protect the identity of each participant. Organizing the data in this format allowed me to accurately attribute direct quotes and other responses throughout the data analysis and results sections.

I began the process of thematic analysis through the first cycle of coding using in vivo coding that involved highlighting, interpreting, and annotating the participants' language from sections of the text (Rubin & Rubin, 2012; Saldana, 2016). Thematic analysis of interview data requires deep interpretation and involvement by a researcher and attention to both implicit and explicit information obtained during the interviews (Guest et al., 2012). Next, I reviewed the highlighted and annotated sections from the transcripts and observations made during the interviews to triangulate the implicit and explicit data from all participants to create codes organized by the interview questions. Coding in qualitative research consists of labeling and organizing data to find patterns and themes across the data (Ravitch & Carl, 2016). Appendix C indicates the results of the first cycle of coding determined through in vivo coding taken from actual transcripts from participants.

For the second cycle of coding, I concisely summarized and combined similar codes to be more succinct. Next, I organized the condensed codes into categories and identified emerging themes across the data. Table 1 displays the codes from the data aligned with the overarching themes that emerged.

Table 1

Second Cycle Coding: Themes Within and Across Coded Data

Codes	Categories	Themes
Prepare for higher learning Experiential learning Teacher facilitator Real-world connection Curiosity Student exploration Ownership of learning	Problem solving Discovery Application of knowledge Critical thinking Investigative learning Student engagement	Inquiry-based science instruction is the preferred instructional strategy by teachers as students are empowered to design creative solutions for real-world problems
Inconsistent use in the classroom No inquiry-based instruction professional development Finding resources independently Planning and flexibility Lose a month of instruction with school events/activities and testing preparation 50-minute instructional period Teaching students how to be test takers Large class size requires more materials and classroom management Insufficient teachers certified in gifted and English for speakers of other languages (ESOL)	Collaborative planning Model inquiry-based instruction as training Materials and resources Instructional time Priority content areas Student diversity	Need for professional development aligned with collaboration and inquiry-based experience as transitioning to the student-centered approach of inquiry-based instruction is challenging
Not enough communication between students Not used often enough Dependence on technology	Requires planning and the desire to plan	Teacher-centered instruction is ongoing and recurrent
School created comprehensive continuous improvement plan designates use of Title I funds Limited administrative awareness of implementation requirements for inquiry-based science instruction	Math and language arts are the priority content areas Administrative process for requesting funds	Science needs to be a priority content area in the school's Title I improvement plan

The themes that emerged from the data were: (a) inquiry-based science instruction is the preferred instructional strategy by teachers as students are empowered to design creative solutions for real-world problems, (b) need for professional development aligned with collaboration and inquiry-based experience as transitioning to the student-centered approach of inquiry-based instruction is challenging, (c) teacher-centered instruction is ongoing and recurrent, and (d) science needs to be a priority content area in the school's Title I improvement plan. The results gathered from the 13 interviews are presented in the next section and are organized using the four themes that emerged from the data. Direct quotes from the interviews are provided as evidence of the authentic experiences of the participants. Furthermore, there were no discrepant cases in the study.

Evidence of Trustworthiness

Trustworthiness in qualitative research consists of credibility, dependability, transferability, and confirmability. The researcher's strict adherence to the research design supports the study's credibility while still focusing on the method for data collection and analysis while attending to the nuances of the data (Ravitch & Carl, 2016). I established the credibility of this study in several ways including the use of member checking. As I transcribed the interviews, each participant received a copy of their interview transcript by email. Two teachers responded with minor corrections and one teacher provided additional information to better explain their original response. The interview questions were developed from my analysis of related literature and testing the interview questions with similar professionals. Integrating interview questions that have been field tested or used in related studies added credibility to the data collection instrument and provided a valid basis for later comparison of results (Kelder, 2005).

I reinforced the dependability of this study by using reflexivity, maintaining an audit trail, and member checking. Using a basic qualitative study design, I followed a data collecting process that aligned with answering the research questions for the study. I engaged in self-monitoring to ensure that I considered alternate explanations. Additionally, I created an audit trail to provide a detailed account of the research process, and how I arrived at conclusions about the data; caution was taken during the interviews, to refrain from adding personal comments.

I addressed transferability by providing a detailed description of this study's procedures, context, participants, and their experiences in sufficient detail that could assist others in duplicating the design, data collection, and analysis process in a variety of useful ways. The thirteen participants of the study, who taught sixth through eighth grade levels, were selected based on purposeful sampling and included a diverse group of educators who provided in-depth responses. The participants provided rich descriptions of their lived experiences and perspectives that support transferability of the findings of the study. While this may have increased the dependability of the findings, it may have decreased transferability to teachers' experiences at other grade levels facing different challenges implementing inquiry-based science instruction.

Confirmability is related to a qualitative study's objectivity where the findings are based on the participants' responses. I was diligent in accurately portraying the participants' responses as they intended. While I addressed confirmability through member checking, I also used reflexivity, which Merriam and Tisdell (2016) described as engaging in self-reflection to identify factors that may influence the researcher’s interpretation of the data. Confirmability was achieved by adhering to an interview guide with follow up prompts for each interview to maintain neutrality and minimize personal bias.

Results

The purpose of this basic qualitative study was to explore Title I middle school teacher and principal perspectives on and experiences with the challenges of delivering inquiry-based science instruction within the framework of Title I requirements. In keeping with the labels used to protect the identity of participants, T1, T2, etc., represents responses from teachers, while P1 and P2 represent the responses from principals. The results and findings of the study revealed four themes from the data analysis that aligned to the research questions and conceptual framework for the study. The conceptual framework for the study combined Dewey’s (1910) theories of experiential learning, and Vygotsky’s (1978) theory of sociocultural constructivism and are supported by participants’ responses in this section.

Four themes emerged from commonalities identified across the data. Following each research question is a theme statement that provides insight on the theme as it occurs in the data followed by the results (Saldana, 2016). Table 2 shows the alignment between the conceptual framework, research questions and themes.

Table 2

Alignment of the Conceptual Framework, Research Questions and Themes

Conceptual framework	Research question	Theme
Dewey's theories of experiential learning where students are provided with opportunities to engage in science as a reflective process	RQ1: What are the perspectives on and experiences with inquiry-based instruction within the framework of Title I requirements of science teachers in a Title I middle school?	Inquiry-based science instruction is the preferred instructional strategy as students are empowered to design creative solutions for real-world problems
		Need for professional development aligned with collaboration and inquiry-based experience as transitioning to the student-centered approach of inquiry-based instruction is challenging
Dewey's theories of experiential learning and Vygotsky's theory of sociocultural constructivism converge	RQ2: What are the perspectives and experiences of Title I middle school principals regarding the challenges to the successful delivery of inquiry-based science instruction within the framework of Title I requirements?	Teacher-centered instruction is ongoing and recurrent
Vygotsky's theory of sociocultural constructivism where the classroom is the agent of social change for the student, to become productive members of the community	RQ3: How do Title I middle school policies and practices impact the delivery of inquiry-based science instruction within the framework of Title I requirements?	Science needs to be a priority content area in the school's Title I improvement plan

RQ1 asked what are the perspectives on and experiences with inquiry-based instruction within the framework of Title I requirements of science teachers in a Title I middle school?

Theme 1

The first theme identified inquiry-based science instruction as the preferred instructional strategy; students are empowered to design creative solutions for real-world problems. Science teachers empower students by facilitating their exploration and discovery of phenomena in their everyday world. All eleven science teachers focused on their beliefs on the importance of inquiry-based science instruction. T1 shared “Inquiry-based instruction involves student investigations about what’s happening around them,” while T2 explained, “Instruction is led by questions that guide students through the scientific process.” T3 expressed that once knowledge is given, students can take the steps to answer questions. T3 stated “Students actually being engaged in their learning allows teachers to take a step back and facilitate.”

T4, T5, T6, T7 and T11 stated inquiry-based science instruction broadens students’ minds by getting them to be more curious of the world around them. T6 stressed “I’m trying to arouse curiosity and critical thinking skills.” T7 commented on getting the students enthusiastic about learning by facilitating the connection between what they learn and what they discover. T11 felt, “a student is successful if they can ask questions about phenomenon around them and solve problems applying what they have learned.”

T8 emphasized the importance of conversation between students and shared, “I like that conversation, whether it’s right or wrong, is going on and the kids are really engaged and defend what they are talking about." T9 further expanded, "I would expect students to be able to not only write about their experiences but take an argumentative stance about their claim." T10 discussed how students doing science have ownership of it and shared, "I'll give them the tools, but they create the inquiries on their own so the learning is more authentic and they complete deeper learning and better understanding."

By empowering students, they take ownership of their future. T1, T3 and T10 agreed that "Inquiry-based instruction prepares students for higher education and beyond." This is further expanded on by T2, "Inquiry-based instruction allows for deeper learning and better understanding even beyond the content of science". T3 felt, "It gets students to actually understand the material to the point that they can apply the concepts instead of just regurgitating information" and T4 shared, "It fosters an enthusiasm to make a claim, argue the claim and substantiate their reasoning with any subject."

From a global economic standpoint, T5 stated, "Inquiry-based science instruction makes the students more rounded and hopefully helps grow the number of people in STEM positions." T7 stressed this sentiment:

> We have to prepare students to be able to occupy STEM position in the future. Education should mirror whatever it is that we need in our society at large. And right now, there's a need for STEM occupations to be filled.

Similarly, T9 noted, "My purpose is to prepare students to occupy STEM jobs so we can make our country as strong as it can be, so that our students and country can be an economically, viable competitor in the global market."

Theme 2

The second theme to emerge from the data was the need for professional development aligned with collaboration and inquiry-based experience as transitioning to the student-centered approach of inquiry-based instruction is challenging. All teacher participants expressed how their level of experience with inquiry-based instruction translates to instruction in their classroom. T1 explained that science teachers are exposed to professional development at least once a month around a central idea, and “the new ideas were are used by all of the teachers.” T3 felt that the use of virtual training leaves teachers unprepared and stated, “There’s only so much you can get being virtual. There are so many science teachers on the virtual training with only one instructor, it’s only so much you can take from it.” And although the district has started to push professional development in science, T8 stated, “I cannot say whether it’s geared towards inquiry based, but I can say I have seen them start doing different things as it relates to science.”

Several participants felt they were left to their expertise to implement inquiry-based science instruction, and their responses indicated their lack of understanding of what was needed for effective implementation. T4 and T6 shared the teachers were given training on software programs, graphic organizers, and assessment tools that all support instruction but are not inquiry-based science instruction. T5 stated they were using the district curriculum as a starting point and making it more engaging but did not feel it was necessarily meeting the requirements of inquiry-based instruction. T8 disappointingly share, “I haven’t experienced training, necessarily, to teach about inquiry based.” T9 emphasized that they were not receiving professional development on inquiry-based science instruction and therefore, "You will not see lots of inquiry-based lessons in my classroom."

Some teachers felt they had sufficient experience they acquired on their own. T2 shared, "I've had extensive training and my administrators trust me as the expert." T10 held several discussions with the school administration including bringing in inquiry-based science trainers during planning periods, but there is never any implementation. T10 stated, "It's pretty much all on my own with very little support from the district. Everyone says we need to increase science literacy and all these other things, but I think we receive minimal support from our district." This was reiterated by T11, "I'm relying on things that I've learned in the past. I do my own research."

All participants reported collaborative planning is good for sharing ideas between teachers. T1 noted in the ninety-minute weekly meeting, teachers collaborate with each other on thoughts and ideas of one particular grade level. T2 stated:

> After 45 minutes of collaborative planning to come up with great ideas, I need another 30 to 45 minutes to reflect on what it needs to look like for me based on my teaching style which is a lot of time.

T3 shared that as one of three science teachers for the seventh grade, they each share how they will present it to their individual classes and help each other out, and stated, "We plan on how we can accommodate all three teams."

Several participants described their collaborative meetings with the other science teachers as weekly requirements by administration. T4 and T6 expressed collaborative planning was instructive, however, there was no support for implementing inquiry-based science instruction. T6 stated, “We exchange assignments and ideas.” T5 explained, “As the seventh-grade content lead, the other two teachers are fairly new, so that my collaboration with them is mostly one way and it typically focuses on students more so than content.” T7 shared, “Sometimes district professional learning requirements get overwhelming where we don’t have time to collaborate.”

T8 was forthright in expressing there was no collaborative planning among the science teachers. T8 shared if there are meetings, it is to talk about lesson plans and achievement data, “But as far as implementing inquiry-based learning, I can’t say that it has been pushed.” T9 further emphasized this, “We are not doing any common planning. That’s not happening. Planning with other teachers just turns into a venting session versus something that’s helpful for moving students.” T11 responded, “Our meetings are more inclined to data, but not the actual practice of inquiry-based science.” T11 solicited participation from the teachers, “Hey, I’ve got these great labs we’ve been doing, the students love it. I’ve got it set up in my room. Come down and see what it looks like,” but they never come, and they’re generally not interested.

Overall, there is a consensus that inquiry-based instruction requires planning time. T1 communicated, “Time is always an issue. There’s never enough time in a day to get all things we want to be accomplished.” T2 shared the same sentiment and added, “For my lesson today, I had to just do it old school off the top of my head, but I think if had the time to plan, it could have been better.” T5 revealed that planning can be a problem when especially when school events disrupt the calendar. Additional interruptions that cause frustration were shared by T7, “Lack of technology, networking, and internet connectivity discourage me from planning inquiry lessons." T11 emphasized, "Planning time is definitely an issue. It's not like planning a regular lesson. It takes me a while to do inquiry-based lesson plans because I'm constantly trying to improve upon lessons I've done so I'm always researching."

Although the participants saw the value in inquiry-based instruction, without further professional development and teacher collaboration, transitioning to the student-centered approach came with additional challenges of lack of instructional time, lack of timely access to materials and resources, and the needs of a diverse student population. The time required to implement inquiry-based science instruction varied for each participant. T1, T3, T7, T8, T10, T11, P1 and P2 all teach at schools where the instructional periods are 50 minutes in length. T2, T4, T5, T6, and T9 teach at schools where the instructional periods are 90 minutes in length. T3 described:

> The class periods are 50 minutes, but between getting them settled in, doing our warmup, that right there eats up about 10 or 12 minutes at least, then going over the warmup, that's another at least 10, 12 minutes. So that leaves you with about 30 minutes to actually get through the activity.

T7 shared, "We get almost an hour, but of course it's not an ideal situation, we always have interruptions." T8 may have a plan for an inquiry-based lesson, but "Planning and implementation are two different things. I still need setup time, time to put things away, and time to prep."

All participants were passionate about inquiry-based science instruction and quickly pointed out science can be expensive especially if teachers were not working collaboratively to effectively obtain and share resources. They were all aware Title I schools do not have the same availability to resources as non-Title I schools to keep students engaged in science. T1 explained, “the school’s CCIP dictates how we can utilize Title I funds and stated, “Science teachers are afraid to ask for materials and resources because they know the CCIP says where the spending must be focused and it’s not science.” T2 shared, “Large classes don’t bother me if you have enough space, but I can’t do anything about not having enough materials and resources for the inquiry activity.” T3 commented, “Kids that are non-Title I are going to have a better science experience because they have way more resources.” T9 shared, “They say with Title I there’s some sort of funds available, but I never see those funds.” T11 said, “I’ve been told there are so many loopholes and requirements that must be met before Title I money can be used for resources.” P1 explained:

> The folks handling Title I funds probably need to go through training in science to understand why we ask for the materials and resources we do. You have to justify buying certain things and they don’t know why you have to get a particular kit therefore it’s denied because if it doesn’t fit their criteria.

P2 emphasized, “Not knowing the difference between a supply and material can cause an order to be rejected and we don’t want our teachers going into their already limited pockets.”

In addition to operational challenges, without effective professional development, the diversity of student populations also impedes the implementation of inquiry-based science instruction. T10 stated, “There are huge gaps with our English to Speakers of

Other Languages (ESOL) population. I am not ESOL certified, and we don't have the supports for those students." T5 explained:

> When you have 10 or 12 students who have poor English skills, and they're reading at a low Lexile level in a class of 31 students, that is a huge impediment to inquiry-based science instruction for them and the entire class.

Furthermore, T6 is a concurrent teacher who stated:

> I teach fifteen students in person, and I have fifteen to twenty students logged on concurrently. One group is going to get the short end of the stick and a lot of times it's the virtual students. I'll put them on a virtual assignment and check-in with them every ten or fifteen minutes. The fact that I'm concurrent lets you know how effective inquiry-based instruction is in my classroom.

RQ2 asked what are the perspectives and experiences of Title I middle school principals regarding the challenges to the successful delivery of inquiry-based science instruction as a reform mandate?

Theme 3

The third theme to emerge from the data was that teacher-centered instruction is ongoing and recurrent. Inquiry-based science instruction, when implemented effectively, prepares students for high order thinking as the teacher's role is facilitator and the student emerges as the investigative learner. P1 revealed, "I think we can leverage the inquisitive nature of the kids into more effective teaching by giving kids ownership when they are investigating their own questions and not just questions crammed with standards." Both P1 and P2 focused on the role of teachers as facilitators. P1 emphasized that, "Much of the learning is on the children and the adults act as the facilitators, but the kids should be working at their level in groups.” P2 commented, “Exploration is fueled by students and not the teachers. Inquiry science is always student-centered discovery with opportunities for teachers to guide their learning.”

Science is the backdrop to teach the framework of critical thinking. P1 stated, “I want our kids to know the critical thinking process and how to approach problems, and how to vet sources.” P2 expressed, “The world is changing rapidly and if our students want to be a part of that change, they will have to develop critical thinking skills. They have to be able to question information being fed to them as facts. I don’t want to teach our students how to be test takers, that’s not a skill anybody really needs for employability.”

The successful readjustment to student centered learning requires intentionally creating a classroom focused on meaning making, inquiry and authentic activity. The two principals emphasized inquiry-based science instruction should be a best practice for all science teachers. P2 shared, “If a teacher does not know how to implement inquiry-based science instruction effectively, it is very hard to work through a curriculum thoroughly and give kids the full experience of learning science.” P1 revealed, “We have glass in front of all of our classrooms and I walk by and just see rooms with kids, with workbooks in front of them day after day.” P1 and P2 noted there is a need for more training for inquiry-based instruction, especially on the middle school level. High-quality, professional development related to the implementation of inquiry-based science instruction models how teachers can transform instruction within their classrooms. P1 emphasized, “What I’m learning now is teachers need to stop depending totally on technology platforms because it takes away from seeing students actively engaged in hands-on learning. Training is necessary to get back to inquiry-based instruction”

Both principals acknowledged the importance of collaboration among science teachers; however, they do not actively monitor it is occurring. P2 echoed the sentiment of P1 who admitted, “I’m just trying to run the school and make sure all the teachers have some basic knowledge of a three-part lesson plan.” P1 and P2 are both very supportive, but do not have much to offer in terms of guidance. They both rely on their academic coaches to provide support to the science teachers. P2 added, “You cannot have effective science lessons without adequate planning time collaboratively and individually. What I notice is the teacher must want to plan.”

RQ3 asked how do Title I middle school policies and practices impact the delivery of inquiry-based science instruction within the framework of Title I requirements?

Theme 4

The fourth theme to emerge from the data was that science needs to be a priority content area in the school’s Title I improvement plan. The comprehensive continuous improvement plan (CCIP) is a planning and grants management tool. The planning tool contains the goals, strategies, and action steps in the CCIP. The grant management tool contains the budget, budget details, nonpublic services and other related pages. All the participants recognized their students struggle in math and language arts; therefore, those content areas are the priority goals, strategies and action steps in their school’s CCIP. T1 mentioned because science is on the back burner to those two content areas, “Science teachers become afraid to ask for funding because they know what was included in the CCIP where the school is focusing resources.” T3 shared,” I’ve seen the type of resources non-Title I schools have and know they are getting a better science experience than our Title I kids because they don’t have a CCIP.” T5 and T6 emphasized there weren’t enough working Chromebooks for the number of students in their Title I schools. T6 added, “It gets frustrating, and it forces me to put students in groups.” T8 felt all attention is on math and ELA because the focus is on scores. T9 noted that even though there may be money in the school’s budget for science they are not offered the opportunity to order resources and materials. T11 added that they were allowed to order materials and resources, “But for whatever reason, sometimes our requests are not honored.” P2 described the requirement for using Title I fund, and stated:

> The folks are Title I probably need to go through a training in science to approve or understand why we ask for certain items. There are companies that have everything you need to teach a topic, but with Title I, you must justify everything you buy.

P1 echoed this:

> They don’t know why you need a certain kit so they reject the request and say it doesn’t fit under the criteria. Knowing the difference between a supply and material gets complicated because they don’t understand what’s needed for inquiry-based science instruction.

T4 stated, “I don’t believe being a Title I school impinges on implementing inquiry-based science instruction.” T7 described how the school has been able to use Title I to meet their science instruction needs and stated, “We do have a good Title I group in our school. They look at test scores and gauge what other supports are needed and line that up in our CCIP.” P1 shared, “The Title I money is there, the resources get in the school, but the kits are sealed, sitting on a shelf and unopened by the teachers.”

Summary

The purpose of this basic qualitative study was to explore Title I middle school teacher and principal perspectives on and experiences with the challenges of delivering inquiry-based science instruction within the framework of Title I requirements. Upon thorough analysis of the data, four themes emerged that may influence implementation of inquiry-based science instruction in Title I middle schools. These themes support the conceptual framework for the study and serve to answer the research questions for the study. The themes are: (a) inquiry-based science instruction is the preferred instructional strategy by teachers as students are empowered to design creative solutions for real-world problems, (b) need for professional development aligned with collaboration and inquiry-based experience as transitioning to the student-centered approach of inquiry-based instruction is challenging, (c) teacher-centered instruction is ongoing and recurrent, and (d) science needs to be a priority content area in the school’s Title I improvement plan.

The analysis of this research identified three key findings, one in relation to each of the three research questions. The first key finding was that the participants’ positive conceptualization of inquiry-based science instruction was consistent with those found in the literature. However, the professional development and support participants received at their schools or from the district was ineffective, insufficient, and inadequate in terms of usefulness, applicability, and relevance. The second key finding was despite training and support, principals described teacher-centered instruction as ongoing and recurrent in the science classroom. The third key finding was there is no inclusion of science in school improvement plans despite the acknowledgement of its importance in student academic development. The findings will inform effective practices and actions that academic leaders may consider to increase the use of inquiry-based science instruction in Title I middle schools.

In this section I provide an explanation of the participant demographics, data collection, and analysis for this study. Additionally, I present the findings in relation to the three research questions of this study. In Chapter 5, I present a discussion of the findings and implications of the study. In addition, the limitations of the study with recommendations for further research are presented. I conclude with positive social changes that may come from the study.

Chapter 5: Discussion, Conclusions, and Recommendations

Introduction

Previous researchers have shown that inquiry-based science instruction empowers students, which positively influences student achievement. More recently, researchers have indicated the advantages of inquiry-based science instruction over traditional instruction for transferring learning to new contexts and increasing achievement. The research problem I addressed in this study was that Title I middle schools in the southeastern United States are facing challenges delivering effective inquiry-based science instruction within the framework of Title I requirements. The purpose of this study was to explore Title I middle school teacher and principal perspectives on and experiences with the challenges of delivering inquiry-based science instruction within the framework of Title I requirements.

I used a basic qualitative study design that was appropriate to answer the research questions for the study. Qualitative research supports the involvement of the researcher in understanding, describing, and interpreting a participant's experience with a phenomenon (Ravitch & Carl, 2016). The three research questions for the study were:

RQ1: What are the perspectives on and experiences with inquiry-based instruction within the framework of Title I requirements of science teachers in a Title I middle school?

RQ2: What are the perspectives and experiences of Title I middle school principals regarding the challenges to the successful delivery of inquiry-based science instruction within the framework of Title I requirements?

RQ3: How do Title I middle school policies and practices impact the delivery of inquiry-based science instruction within the framework of Title I requirements?

Data for this qualitative study were collected through in-depth teleconferencing interviews to answer the three research questions. As a result of the data analysis from the interviews, four inquiry-based science instruction themes emerged. These themes were used to answer the research questions for the study. RQ1 was answered through Themes 1 and 2, RQ2 was answered through Theme 3, and RQ3 was answered through Theme 4. The following four themes were identified:

- Theme 1: Inquiry-based science instruction is the preferred instructional strategy by teachers as students are empowered to design creative solutions for real-world problems. Inquiry-based science instruction, when implemented effectively, prepares students for high order thinking as the teacher's role is facilitator and the student emerges as the investigative learner. Students are empowered to design creative solutions for real-world problems.
- Theme 2: Need for professional development aligned with collaboration and inquiry-based experience as transitioning to the student-centered approach of inquiry-based instruction is challenging. Science teachers' experiences with inquiry-based instruction translates to instruction in their classroom and academic growth.
- Theme 3: Teacher-centered instruction is ongoing and recurrent. The successful readjustment to student-centered learning requires intentionally creating a classroom focused on meaning making, inquiry, and authentic activity.

- Theme 4: Science needs to be a priority content area in the school's Title I improvement plan. The CCIP should contain goals, strategies, and action steps for science including a budget and budget details.

The findings of the study support and enhance existing research on the importance of inquiry-based science instruction on student achievement. As a result of my study and from the lens of a practitioner researcher, I have developed a deeper understanding of the perspectives of principals and teachers and the challenges they experience implementing inquiry-based science instruction in Title I middle schools. The data analysis grounded by the constructs of the conceptual framework and informed by the four themes that emerged from the study provided answers to the research questions.

Interpretation of the Findings

For this study's conceptual framework, Dewey's (1910) theories of experiential learning and Vygotsky's (1978) theory of sociocultural constructivism were combined. Contemporary models of inquiry-based instruction build on these theoretical frameworks by emphasizing the importance of a learner having the opportunity to explore scientific concepts before formal explanations of the phenomena are provided, thus facilitating conceptual understanding (Bransford & NRC, 2000; Bybee et al., 2006). The theories converge on the concept of student-centered active learning, which grounded my study and was reflected in the four themes that emerged from the data analysis.

Experiential Learning

Effective inquiry-based science instruction aligns with Dewey's (1910) experiential learning approach to problem solving with the teacher as the facilitator and students making their own discoveries. Studies have shown inquiry-based science instruction increases the value of science for young adolescents (Dorph et al., 2018; Giesige, 2017; Shumow & Schmidt, 2014), makes it exciting, and changes their outlook on their future (Dorph et al., 2018; Filgona et al., 2020; Scogin et al., 2017; Shumow & Schmidt, 2014). Students understand their teacher is there to facilitate their learning as they work through their own difficulties and improve their problem-solving abilities unafraid to "fail forward" until they succeed (Darling-Hammond et al., 2020; Larmer, 2016, p. 69). Identifying the challenges of implementing effective inquiry-based science instruction in Title I middle schools within the framework of Title I requirements is of great importance to student academic achievement. The educators I interviewed provided examples of inquiry-based science practices that were effective but inconsistent.

The literature reviewed for this study indicated that inquiry-based instruction is recognized as a bridge for connecting ideas to coherent learning experiences and for actively engaging students in learning science. The findings of my study will contribute to the existing body of research regarding the inconsistent use of inquiry-based science instruction (Capps et al., 2016; DiBiase & McDonald, 2015; Fitzgerald et al., 2019; Lakin & Wallace, 2015) in Title I middle school science classrooms. Furthermore, my findings support research asserting that lack of teacher experience with scientific inquiry can be a major challenge to implementing inquiry-based science instruction (Hirn et al., 2018; McLaughlin & MacFadden, 2014; Vedder-Weiss & Fortus, 2018) in Title I middle school science classrooms.

Professional Development and Collaboration

Effective inquiry-based science instruction also aligns with Dewey's (1910) model of the science classroom created by teachers knowledgeable in creating learning situations through demonstrations and leading questions. Inquiry-based science instruction intentionally shifts the teacher's focus from providing just facts to providing a learning environment that emphasizes operative thinking and attitude of mind (Dewey, 1916).

Professional development improves science teachers' pedagogical content knowledge and enhances their teaching skills in implementing effective inquiry (Eltanahy & Forawi, 2019; Fitzgerald et al., 2019; Marshall et al., 2017). Under a pedagogy of constraints, teachers are less likely to collaborate and engage in research that informs their teaching (Giroux, 2016). For instructional practices to change, science teachers must have multiple opportunities to see and practice inquiry-based science instruction (Marshall & Alston, 2014). The participants in my study described their experiences with professional development aligned with collaboration and inquiry-based experience as having no impact on their teaching practices. The findings of my study will contribute to studies showing that science teachers are more likely to use inquiry-based instruction consistently if they are comfortable with a clear model of inquiry that meets science standards, considers teacher reflection, and fits into the existing curriculum, timeframes, and other school environmental factors implemented by leadership. (Blanchard et al., 2013; Fitzgerald et al., 2016) in Title I middle schools. Furthermore, the Title I middle school participant responses support the research that science teachers want to make a difference in students' lives but need the knowledge and tools to do it. Consequently, teachers' focus with task-related concerns will diminish with extensive support from effective collaboration with peers (Dailey & Robinson, 2016), and teachers will no longer cling to the didactic presentation of facts (Schwab, 1958).

Student-Centered Instruction

The interactive environment of effective inquiry-based instruction through social interactions aligns with Dewey's (1916) explanation that the classroom is an inherently social organization representative of the larger social community. Still, the student must recognize themself as a viable agent of change for that social organization. To do this, the student must realize that they have some element of control over classroom activity. The interactive environment of effective inquiry-based instruction through social interactions also aligns with Vygotsky's (1978) explanation that the influence social and institutional settings in which the student lives are the agent of change for students; the purpose of education is to become productive members of the community. According to Vygotsky (1978), opportunities like inquiry-based science instruction should be created for student learning to occur in a social setting; students develop knowledge through cooperative, social interactions in the classroom. Research shows more time should be spent by science teachers facilitating a collaborative learning environment that provides just enough freedom for students to communicate and negotiate with each other and supporting their developing analytical skills when interpreting information (Chu et al., 2017; Kuhlthau et al., 2015; Scogin, 2016). The social world is complex and is characterized by heightened participation in upward social mobility, socialization into the local community and extensive cultures, and an increasingly informed citizenship, all of which rely on a deeper knowledge of science (Bivens et al., 2016; Chu et al., 2017; Fayer et al., 2017; Garcia & Weiss, 2017; U.S. Bureau of Labor Statistics, 2020).

The principals interviewed in the study demonstrated an understanding of the power of inquiry-based science instruction by recognizing the need for science teachers to readjust their lesson plans to include more student-centered learning. Principals believed science teachers must intentionally create a classroom focused on meaning making, inquiry and authentic activity. Moreover, as argued in research and supported by this study, the principals were keenly aware of the importance of the use of inquiry-based instruction in the science classroom to provide the inventive activities to meet the written and oral communication skills, critical thinking skills, the ability to apply knowledge, teamwork skills, and ethical decision-making skills for STEM related careers (NRC, 2000). Principals have a vision that aligns with the technological innovation requirements of expertise in STEM to support economic growth (Andrini, 2016; Chu et al., 2017; Rothwell, 2013).

As the results presented in Chapter 4 indicated, I found principals emphasized the direct correlation between the science teacher's knowledge of inquiry-based science instruction and the experience some students may have of learning science in one classroom compared to another science teacher in the same building. The principals reported they work to be visible in classrooms to observe instruction. When they enter a classroom, see students actively engaged in the lesson, and hear them communicating with each other and asking questions, there is a deep satisfaction that learning is taking place. The Title I principals of the study support the research by confirming they see the assigned tasks are challenging yet manageable and achievable with the support provided in the form of questions, demonstrations, or the facilitation of the generation of hypotheses by the teacher (Chu et al., 2017; Kuhlthau et al., 2015; Scogin, 2016). In contrast, the principals discussed their disappointment with the didactic approach to learning in another science classroom; there is complete silence and students are using textbooks and completing worksheets. These Title I middle school students’ experiences support what research identifies as a systemic problem of science teachers facing the difficulty of planning, scaffolding for differentiation, monitoring, and modeling inquiry-based science instruction (Alston et al., 2020; DiCicco et al., 2016).

The principals in the study were aware of intentional professional development to improve science teacher’s pedagogical content knowledge of inquiry-based instruction as well as enhance their teaching skills in implementing effective inquiry was much needed. The findings of this study support the results of Blanchard et al. (2013) and Fitzgerald et al. (2016) that science teachers are more likely to use inquiry-based instruction consistently if they are comfortable with a clear model of inquiry which meets science standards, takes into consideration teacher reflection, and fits into the existing curriculum, timeframes, and other school environmental factors implemented by leadership. As shown in research and presented in Chapter 4, I found both principals were aware of the challenges teachers experienced: time consumption, confusion due to the complexity of inquiry, job requirements, and economics (Schwab, 1958). Although they made collaborative planning a requirement to mitigate some of those challenges, they were not actively monitoring the effect of the weekly meetings.

Research shows preparing students in science or technology fields is more important than ever to provide the skills required for technological innovation, and principals must guide teachers on forming strategies to develop and implement instruction for students to establish a school climate that is conducive to student achievement (Gurr et al., 2010; Larmer, 2016; National Science and Technology Council, 2018; Scogin, 2016). Although they acknowledged their need to improve administrative support, they strongly emphasized teachers must also desire to plan an effective inquiry-based science lesson. When teachers believe it is difficult to implement inquiry-based science instruction on a consistent and regular basis, they default to teacher-focused instruction to directly mirror high-stakes measures of accountability (DiBiase & McDonald, 2015; DiCicco et al., 2016; Marshall et al., 2017). The Title I middle school science teachers in this study expressed transitioning to the student-centered approach of inquiry-based instruction as challenging. As a result, I found teacher-centered instruction was ongoing and recurrent.

Title I Requirements

As the results from chapter four indicated, science needs to be a priority content area in the school’s Title I improvement plan. Effective inquiry-based science instruction plays a role in narrowing the achievement gap in STEM and supports the argument that inquiry is beneficial for all learners. As Vygotsky (1978) proposed, the purpose of education is to meld children into the larger social structure so that they become productive members of the community. It is the responsibility of the social organization, and the larger social community, to be the agent of change in students.

As a condition for receiving Title I funds, principals must have a CCIP delineating how their academic accountability system has adopted challenging content standards and aligned academic achievement standards in reading/language arts, mathematics, science and any other subject chosen by the state (U.S. Department of Education, 2017). The future resources of a Title I school are negatively impacted by the academic performance of their students (Ames et al., 2020), and uncertainty, isolation and in-effective school operation are fostered as more resources are devoted to reconfiguring operations to maximize student test scores (Natriello, 2009). A cycle of inequality is perpetuated as the limited capability to attract quality resources generates further inequality at the expense of a broad curriculum (Ames et al., 2020; Farvis & Hay, 2020).

The Title I middle school teachers and principals of this study demonstrated an understanding that students struggled in math and language arts; therefore, those content areas are priority goals, strategies and action steps in the school’s CCIP. As a result, curriculum and instruction are narrowed and fragmented into test-related topics (Au, 2007; Morgan, 2016); instructional time for non-tested subjects receive less attention and fewer resources (Goertz & Duffy, 2003). Research supports the belief of the teachers in this study that the manner in which principals engage with and address the data-driven accountability measures and local mandates reveals their approach to negotiating and mediating to comply with testing and data-monitoring policy directives (Dotson & Foley, 2017; Koyama, 2014). In this study, the teachers with principals who addressed accountability measures and supported them with resources were more likely to implement inquiry-based learning in their classroom. While those teachers without the support of their principal or sufficient resources felt what research has shown is a cycle of inequality perpetuated as the limited capability to attract quality resources generates further inequality at the expense of a broad curriculum (Ames et al., 2020; Farvis & Hay, 2020).

The science teachers and principals of this study emphasized the power of effective inquiry-based science instruction by emphasizing the importance of professional development to address inquiry-based modeling and team collaboration to create a learning environment that supports academic growth. Additionally, I found the science teachers and principals emphasized the systems and structures they have in place in their schools should be modified to empower teachers to plan collaboratively for improved instructional practices. Equally important, the principals recognized the importance of quality professional development, mentoring support, and the communication of a clear vision to positively impact the implementation of inquiry-based learning in the classroom. The themes that emerged from the findings in this study centered on the importance of effective inquiry-based science instruction and the importance of building the capacity of teachers to positively impact students. In addition, school CCIPs should include science as a priority when addressing the academic needs of students.

Limitations of the Study

The findings from this study may not be transferable due to the small population of 13 educators studied from one district in Northern Georgia. Although this was sufficient for reaching a point of saturation in the data of the educators' experiences, broadly applying the findings of this study could be challenging. Another limitation of this qualitative study is that only middle school educators from one district were selected, and therefore the results may not be transferable to high school educators. With such a small number of participants for the interviews, the results were insightful but could not be applied across other school districts, teachers, and principals.

I was the sole person responsible for collecting the data. Potential researcher bias existed because I worked in the district and taught ninth through 12th grades during my career. Additionally, I may have attended professional development training with one or more of the participants. I used member checking to allow each participant to review the descriptive interpretation of their responses to ensure the accuracy of their intended responses.

Recommendations

Further recommendations for further research studies on this topic are:

- increase the number of participants in the study to gather additional perspectives on inquiry-based science instruction in other Title I middle schools in other districts;

- Title I middle school with consistent, effective inquiry-based science instruction professional development opportunities and the use of inquiry-based science instruction in the classroom;
- Title I middle school CCIPs that include science as a priority content area and the use of inquiry-based science instruction in the classroom.

Implications for Social Change

There are implications for positive social change this study presents that may influence the educational outcomes for students attending Title I middle schools. Students who attend Title I schools continue to underperform academically as compared to their more advantaged peers (Hirn et al., 2018; Riga et al., 2017). By falling short of educational benchmarks, students from Title I schools will enter the workforce with extensive skills gaps, lowered economic prospects later in life, and little influence on the economic growth of their community thereby perpetuating a lack of social mobility across generations (Garcia & Weiss, 2017; Suggs, 2017).

Research has consistently shown that effective and consistent inquiry-based science instruction influences academic outcomes for students and better prepares them for their future. The use of inquiry-based instruction in the science classroom provides the inventive activities on which middle school educators can focus to meet the written and oral communication skills, critical thinking skills, the ability to apply knowledge, teamwork skills, and ethical decision-making skills for STEM related careers (NRC, 2000). Inquiry-based science instruction may raise the academic benchmark for educators and their students, and aligns with the goal of providing a safe, respectful and academically rigorous learning environment wherein all stakeholders work together to prepare students to compete globally and to become successful, contributing members of society. This may provide economic growth in communities as these students accept employment in local STEM businesses versus leaving the state and taking away from their communities.

I present teachers' and principals' perspectives and experiences to further the development of inquiry-based science instruction within the Title I framework in the quest for access to equitable, empowering education for all students. Based on their experiences, the following recommendations may be considered:

- providing training and modeling of effective inquiry-based science instruction as a required, paid summer professional development opportunity for middle school science teams.
- offsetting the cumulative pressures of curriculum completion, classroom management, and accountability with a designated school science coordinator who prepares and supports the implementation all inquiry-based instruction activities for the middle school science team;
- inclusion of science in the middle school CCIP and interdisciplinary science instruction using the NGSS as a guideline.

These recommendations may serve as guidance to inform decisions on methods by which science could be taught in Title I middle schools to improve academic outcomes for students and contribute to positive social change.

Conclusion

In this basic qualitative study, I present data on Title I middle school teacher and principal perspectives on and experiences of inquiry-based instruction in the science classroom within the framework of Title I requirements. This research study contributes to the existing body of research on inquiry-based science instruction in the context of Title I middle schools. The study presents four overarching themes found in the data that propose effective inquiry-based science instruction requires administrative support to build the capacity for teachers to positively impact student growth. The results of this study may provide information on the extent to which Title I requirements challenge the delivery of inquiry-based science instruction in the middle school learning environment and may contribute to producing more effective teaching practices. I recommend effective practices and actions by academic leaders be based upon the ideas contained in the four themes identified in this study: (a) inquiry-based science instruction is the preferred instructional strategy by teachers as students are empowered to design creative solutions for real-world problems, (b) need for professional development aligned with collaboration and inquiry-based experience as transitioning to the student-centered approach of inquiry-based instruction is challenging, (c) teacher-centered instruction is ongoing and recurrent, and (d) science needs to be a priority content area in the school's Title I improvement plan.

Society cannot thrive in a technological, knowledge-based economy by starving segments of its population of comprehensive learning. The future of individuals and nations is increasingly interdependent. The influence of inquiry-based science instruction on student achievement is still debated, however, inquiry-based instruction offers better chances for students' career prospects and future life (Garcia & Weiss, 2017) and an equitable opportunity to achieve the American dream. The inclusion of teachers' and principals' perspectives and experiences may facilitate the further development of inquiry-based science instruction within the Title I framework in the quest for access to equitable, empowering education for all students.

Throughout the United States, there continues to be a call for science literacy. These research findings will inform the work of educational reform, professional development, teacher preparation programs, and researchers who aspire to improve the quality of student learning and science instruction for all students. Listening to teachers and principals present their perspectives and experiences demonstrated their continued passion for growing as professionals infusing new ideas with their tried and true.

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Appendix A: Interview Protocol

Interview Research Questions Protocol

Interviewee Code #:

Date: Location:

Time Start: Time End:

Good (morning/afternoon) Mr./Ms./Mrs./ ________________ this is Kirsten King. How are you today?

Thank you very much for taking time to participate in this research study. As you know, the purpose of this interview is to gather your perspectives on the implementation of inquiry-based science instruction in your school. This interview should last about 45 to 60 minutes. After the interview, I will send you a transcript of our conversation so you may review it for accuracy before I examine your answers for data analysis purposes. However, I will not identify you in my documents and no one will be able to identify you based on your responses. This study is voluntary, and you have the right to end this interview at any time. The interview will be recorded for efficient transcription and analysis of your responses. Please answer as honestly and openly as you can. Do you have any questions before we begin?

Interview Questions	**Response**
Research Question 1	
1. What is the primary goal of science instruction?	
2. How do you define inquiry-based science instruction?	
3. How would you characterize effective inquiry-based science instruction?	

4. To what extent do you use inquiry-based science instruction?	
5. Can you describe a time when you planned and implemented inquiry-based science instruction in your classroom? Possible Probes: a. What demographic factor(s), such as such as number of class period preps, area of certification, years of experience teaching science, class time, planning time, inquiry-based science instruction training, supplies and materials, and class size, contributed to and detracted from positive student experiences with inquiry-based science instruction? b. What support(s), such as administrative guidance, professional development, and collaborative planning, allowed for your use of inquiry-based science instruction?	
Research Question 2	
6. What is the primary goal of science instruction?	
7. How do you define inquiry-based science instruction?	
8. How would you characterize effective inquiry-based science reform in your school?	
9. To what extent is inquiry-based science instruction being used in your school?	
10. What challenges do you encounter when implementing inquiry-based science instruction reforms in your school?	

Possible Probes: a. What demographic factor(s), such as such as number of class period preps, areas of teacher certification, years of experience teaching science, teacher attrition and retention, class time, planning time, inquiry-based science instruction training, supplies and materials, and class size, contribute to and detract from positive student experiences with inquiry-based science instruction in the classroom? b. What support(s), such as guidance, professional development, and time for collaborative planning, do you provide your science teachers for the use of inquiry-based science instruction.	
Research Question 3	
11. What challenge(s) do Title I requirements place on implementing inquiry-based science instruction? Possible Probe: a. What factor(s), such as resources, standardized testing, achievement gaps, and sanctions, contribute to and detract from positive student experiences with inquiry-based science instruction in the classroom?	
12. To what extent can inquiry-based science instruction be used to cover all science standards in preparation for end of year assessments? Possible Probe:	

a. If given the opportunity to plan and design inquiry-based science instruction within the framework of Title I requirements for teachers in your school or in the district, what would it look or feel like?	
13. Do you have any questions for me? Is there any other information that you would like to share? I will send you a copy of the interview transcript for your records. Thank you for your time and participating in this study.	

Appendix B: First Cycle Coding: Codes Determined Through In Vivo Coding

Interview questions	Codes
1. What is the primary goal of science instruction?	Prepare for higher learning. Problem-solve real world issues. Apply scientific concepts. Open children's minds. Elicit a desire for learning science. Prepare students for STEM positions. Critical thinking. Real-world connection.
2. How do you define inquiry-based science instruction?	Investigate what is happening around them. Question guides the instructional process. Identifying a question and the steps needed to answer the question. Empower students to ask questions and investigate getting the answers. Feed curiosity. Broaden students' minds. Arouse curiosity and critical thinking skills. Looking at problems and finding solutions for them. Exploring for themselves. Experiencing science like an investigator. Phenomenon based instruction. Ask questions about phenomenon around them and solve problems. Give students ownership to investigate their own questions. Discovery.
3. How would you characterize effective inquiry-based science instruction?	Lots of communication between students. Questions lead to more questions. Students are able to answer the overarching question for the unit. Teacher is a facilitator. Students are engaged. Students ask deep diving questions and interact with the questions. Imagination running wild. Aha moment. Enthusiastic about learning. Spark student interest. Make a claim and argue that claim and having to substantiate their reasoning. Student ownership of their learning. Authentic, deeper learning and better understanding. Apply what they've learned. Work together in groups.
4. To what extent do you use inquiry-based science instruction?	Daily. Not often enough, but I try. Constantly. Once or twice a week. Almost a daily occurrence. As often as I can. A lot, about 80% of the time; Gung-ho about inquiry. Somewhat in demonstrations. Once or twice within a month. Spend a week on it or even more. Try to use it with every unit. Do not use it often.
5. Can you describe a time when you planned and implemented inquiry-based science instruction in your classroom?	Today with the weather, why is this happening? Why is it lightning outside? Recent lesson on waves – make predictions then investigate and verify their hypothesis – tied to sound light and sound of storm that day. How the ecosystem was affected by bald eagles going extinct-50/50 effectively implemented. Communalism – claim, evidence, reasoning (CER). Owl pellet dissection and wildlife sanctuary – hands on experience. Bernoulli's Principle – soda bottles – students engaged and connect to real airline pilots, flight attendants, diving. Students provided materials – figure out the process. Organisms in the food chain – energy distribution using kinesthetics. NOAA – ocean data for hurricane CER.
6. How would you characterize effective inquiry-based science reform in your school?	Quality and quantity of student generated questions. Student centered. Kids are able to work independently as much as possible. Adults should be a facilitator. Communication back and forth between students.

7. To what extent is inquiry-based science instruction being used in your school?	Once instruction became a single discipline per grade level (earth, life, physical), more opportunity to see students explore more with their inquiry. Do not use it often. Walk by science classrooms and students sitting and teacher lecturing. Seventh and eighth grade should be using it daily. Assessment scores do not reflect deeper learning and better understanding of science. Professional development is limited. Could benefit from having more training. Haven't experienced training, necessarily, to teach about inquiry based. Training is the utmost important thing for implementing inquiry-based science lessons. Collaborative planning to share ideas. After collaborative planning, need another 30 to 45 minutes making it look like what it needs to look like for me based on my teaching style and based on my teacher efficacy. That's where collaborative planning falls short. We're all doing the same thing and help each other out – how to implement in your class and address misconceptions that may come up. Planning together with content team has been instructive. Two teachers on content team are new, so collaboration with them is mostly one way. Collaboration with other teachers on the team centers around students more than content. Exchange ideas, but as a concurrent teacher the implementation of assignments is challenging. Class time, we get an hour, but of course it's not an ideal situation, we always have interruptions. Collaborate and talk about data but no discussion about using inquiry-based instruction. Collaborative planning just turns into a venting session versus something that's helpful for moving students. Sometimes, we're dealing with coaches who are great people in and of themselves, but they may not be science teachers. As a lab coordinator, only a couple teachers made it a priority to rotate their students in the lab to have meaningful hands-on, inquiry-based experiences.
8. What challenge(s) do Title I requirements place on implementing inquiry-based science instruction?	*Finances* – Science can be expensive. CCIP dictates how we can utilize Title I funds. Challenges of students struggling in the area of math and language arts or reading, those content areas become priority and science and social studies is put on the back burner. Teachers afraid to ask because they know CCIP says where money is focused. Title I funding all comes through whatever we put in CCIP. Administrative support – pitch in and try to contribute to things financially if needed. Materials for larger classes is difficult. Lack of resources compared to non-Title I schools. Access to whatever is needed for instruction. Technology – not enough functioning Chromebooks for the students gets frustrating. Access to resources but sometimes have to purchase out of pocket. Resources are very important. When a school has nothing, it is very difficult to do labs. There are funds available, but I never see those funds or requests are not honored. Materials can be difficult, depending on the complexity of the lab. Instead of using science budget for new science investigation, used for paper or books, etc. The people managing the Title I funds need to go through a training in science understand why we ask for certain things. With Title I, you have to justify buying certain things.

Time-Always an issue. There is never enough time in a day to get everything accomplished. Class periods are 50 minutes. Once you get kids settled, do warm-up, left with 30 minutes to actually get through the lesson. Planning and implementation of inquiry-based lessons are two different things. Need setup time, put it that way, and prep time. Class periods are 90 minutes so there is time to do inquiry-based instruction but not enough time to plan them. Very well-educated with extensive training but execution falls apart when you don't have planning time. Planning time can be a problem – school events/activities "come up" and the schedule gets thrown off. It doesn't all have to happen in one day. It can happen over the course of days. it does take a lot of class time, compared to traditional learning. We miss 19 instructional days out of the year with fall, spring, fall, winter, spring Measure of Academic Preparation (MAP) testing, plus end of grade testing, then you throw in field days, pep rallies you end up missing about a month of instruction.

End of Course Assessments-Science teachers help out with math end-of-year assessment preparation. For the month of March until mid-April, science teachers use half their period to prepare students for the math assessment. There is no standardized testing in the seventh grade, only in eighth, so there isn't a lot of pressure prepping them for end of year testing. Standardized testing does not take away from inquiry-based. The conversation that comes from the data puts a lot of pressure like it's punitive and is more the stigma and stress-related than the actual test. science gets that push that it needs, it's usually based on the numbers for math and ELA. there is so much of an emphasis on getting kids to pass the milestone. So focused on behavior and testing aren't giving students the opportunity to engage in anything creative. Holding students back and forcing them just to be workers and not leaders and not innovators. conditioned in Title I schools. We're teaching these kids how to be test takers and that's not a skill anybody really needs.

Administrative Support-Administrators are not science educators, so they trust teachers as experts; they're just trying to run the school. Administrators make sure all teachers have basic knowledge of a three-part lesson – surface level awareness of what it takes to get inquiry-based lesson implemented. The support in the school building is very dear. STEM Fridays to expose students to scientific inquiry in the event a teacher has not implemented inquiry in their classroom. No support for using inquiry-based science instruction. It's not a big push with our administration. They're not bringing in facilitators, we're not receiving professional development and we're not doing any common planning. Strong emphasis on following the pacing guide, following the plans that have already been established for us, and those are rarely inquiry-based. Receive very little support from whoever's the district science coordinator. Science teachers from all over the state at science convention who got the day off and their districts paid for them to go, but our district didn't do that.

	Class Size-Large classes don't bother me if you have enough space. It's about the density. Class size is challenging when in a co-taught setting but there is no co-teacher, and you have to meet assessment expectations with 50-minute classes. Class size is large but manageable. When there are large classes, as a concurrent teacher – students face-to-face and virtual – one group is going to get the short end of the stick. Students give trouble because they're not challenged. They're not challenged, so they in turn challenge the teacher with bad behavior. When you have a lot of students it may take more days to complete the lesson but there's a way in which to figure things out. *Experience*-Teachers are certified and knowledgeable in the content they are teaching. Teachers have been exposed to inquiry-based instruction and training is ongoing. Not enough years of experience to give the best instruction yet. Enough years of experience for it not to be a factor with using inquiry instruction. Teachers don't want to get gifted certification because it is quite brutal. Principals move you around or you find out when you get back in August, you're teaching sixth grade when you went to two eighth grade summer professional learning classes. The movement of teachers without giving them enough time to train takes a toll. Years of experience teaching science is less important as long as you have a good training. Large English for Speakers of Other Languages (ESOL) population and there are no science teachers ESOL certified.
9. To what extent can inquiry-based science instruction be used to cover all science standards in preparation for end of year assessments?	Daily inquiry-based learning every day makes our students more engaged with thinking through processes. Most questions on standardized tests are inquiry-based learning. If the prep work is done in the summertime prior to school starting. Should not be planning and flying the plane at the same time. Gives a better way of presenting material instead of having students memorize and teachers lecturing; it allows them to apply it, then it'll stick with them better. Have students using more technology like what they would use and see in real science labs. Make the district curriculum more engaging and move away from "sit and get". Children should be given a senior project as a measurement for matriculation. Not using it every single day but it can be used per standard or per unit. A skilled person could design a lesson that incorporates several different science standards and incorporate different interdisciplinary standards. Scratch standardized assessments as we know it to encourage true and free thinking. Science that is level-appropriate, but rigorous at every step with spiraling concepts that wrap themselves in every single facet and argumentative writing embedded in the lesson. Inquiry-based instruction should be the standard for all schools and guided by the Next Generation Science Standards (NGSS). Every science teacher would get training on NGSS, next generation science standards. Retool the entire district with an inquiry-based science system. Every science teacher in the district would get argument-based inquiry or inquiry-based training. Focus on the NGSS rubrics of student success towards all layers of student understanding. Classrooms designated for labs that have all the materials. Having a lab coordinator with a designated lab filled with labs that align with the benchmark standards who sets up, implements, and resets the labs for all the grades.