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Educational Leadership Doctoral Program

Approved:

Chair, Dissertation Committee

Director, Doctoral Program

Member, Dissertation Committee

Dean, National College of Education

Dean's Representative

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Educational Leadership Doctoral Program

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Abstract

The purpose of this evaluation was to analyze the leadership characteristics of principals and determine how the characteristics influenced science achievement. The context of this inquiry was a school system in the southern United States where 55% of elementary students scored below grade level on the end-of-grade science assessment compared to the state average of 36%. I conducted a mixed-method study using extant science achievement data, science teacher survey data, principal survey data, and principal interview data. The survey and interview data demonstrated a disconnect between teachers' perceptions and principals' perceptions of science leadership provided by the principals. I recommended a policy to improve science scores by providing professional development for principals. The policy included eight action steps to improve student proficiency in science: analyze science performance, set science goals, define instructional practices, establish clear priorities and parameters in which to act, build instructional capacity in the principals, establish indicators to monitor, align leadership behaviors to facilitate the change, and celebrate small wins (Odden, 2012; Kotter, 2012).

Preface

During the spring of 2016, my daughter was nominated for the Governor's Honors Program in multiple categories. She chose to apply for science as it was her area of passion. She was ecstatic as only the top one percent of the state participated. My daughter prepped and prepared for weeks for the selection process. We need to travel to a major city in the state for her interviews. When she exited the interview, her face told it all. Once we were in the car, she cried for most of the four-hour ride home. I will not forget her words as she sobbed she was stupid compared to the kids in the metro area.

As a mother of two children who love science, I have made it my mission to advocate for equal opportunities for science education. A child's zip code should not define the learning opportunity presented to them. Therefore, as a system leader, I found a moral responsibility to study the reason for a low-performing science program in the school system. I hoped the findings from my study would provide clear direction on how to correct the low science achievement in the schools.

Acknowledgments

This adventure has been one I never thought I would accomplish. Both of my parents were high school dropouts. I was the first person in my family to go to college. As statistics were stacked against me, I never dreamed of earning a higher education, let alone earning my doctoral degree. This adventure would not have been possible without the constant pouring into me.

Thank you, Dr. Thomas Buchanan and Dr. Pamela Buchanan, for constantly pushing me to continue my education and believing in me. Pamela, you will never know the extent of my gratitude and love for you. You took a chance on me so many years ago as your assistant principal, and I am eternally grateful. You have taught me so much along the way.

Thank you, Dr. Lorrie Butler, for being my dissertation chair and Dr. Sparks for being my Co-chair. I'm not sure I would have finished without you all. When my world got turned upside down, you all were understanding and supportive. Thank you for encouraging me and checking on me along the way. I would not have finished without you.

Dedication

This dissertation is dedicated to my grandparents because they constantly pushed me to further my education. Without them planting the seed of education, the thought of furthering my education would not have been possible without you.

To my parents, your unconditional support and love throughout the years is the reason I could and wanted to push on through this process. I love you more than you will ever know.

To my two beautiful children, don’t let anything define you! You can accomplish anything in life as long as you put forth the effort. Aim big, enjoy life and love what you do. I love you both.

To my husband, thanks for giving me the space and time to embark on this journey. It has not been easy, but we did it.

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Chapter One: Introduction

The state under study adopted a new set of science standards based on the Next Generation Science Standards (NGSS) during the fall of 2016. Even though the state used the NGSS as a guide, the state's adopted grade-level standards did not align with the Next Generation Science Standards. The state did not implement the science standards until 2017-2018 to allow teachers and the school systems time to provide professional development on the new science standards. The school system under study did not participate in any state-level training provided.

The rural school system under study had ten elementary schools, one gifted center, one middle school, one junior high school, and one high school. The elementary schools and the gifted center qualified for Title I status based on families' socio-economic status. According to the web page for the school system under study in 2019, 33% of the students in the school system lived in poverty. The school system under study had a 12% higher poverty rate than the rest of the state. Therefore, the student population was considered 100% economically disadvantaged based on the Community Eligibility Program (CEP). Accordingly, the CEP allows the nation's highest poverty school systems to serve free breakfast and lunch to all students.

The total school system population was approximately 9000 students (citation withheld to protect confidentiality). Student enrollment had steadily declined each year in the five years before this study. The student demographics consisted of 40% White, 32% Hispanic, 26% Black, 3% other (American Indian and Multi-Racial), and 1% Asian. Over the last decade, the White and Black student enrollment declined while the Hispanic student enrollment increased.

Science instruction was not a primary focal point in the school system under study compared to ELA and math instruction. This was due to the heavy weight given to the results of the English/language arts (ELA) and math assessments in the state accountability system. Content mastery of ELA, math, science and social studies accounted for 40% of the school's grades. However, 2.5 points of the score for content mastery was derived from science compared to 7.5 points from ELA and 7.5 points from math. The State Department of Education assessed science in grades five, eight, and ten, and there was a steady decline in the science state assessment results for the school system under study. There was no culture of learning focused on what students needed to know or on student progress in science in the school system under study.

As school principals were allowed freedom with scheduling, each principal set the parameters in scheduling science for their school. The majority of schools alternated a forty-five-minute block between science and social studies. The amount of time dedicated to science and social studies resulted in teachers trying to teach the standards in half the amount of time provided for subjects such as English/language arts and math. The majority of elementary schools in the school system under study did not have goals for increasing science achievement. The school system under study purchased an online resource, *Mystery Science,* for elementary schools. *Mystery Science* follows the 5E instructional delivery model in science and directly aligns with NGSS. The 5E delivery model is an instructional method of teaching science where teachers guide students through content by engaging, exploring, explaining, elaborating and evaluating. During classroom observations, observers noticed that teachers were following the grade-level activities in *Mystery Science*. Therefore, teachers were following the pacing of *Mystery*

Science, resulting in off-grade-level instruction and creating gaps in content knowledge for students. Additionally, elementary teachers were not following the science curriculum guide provided by the school system under study. As a result, in the state's accountability platform, the most significant gap in student achievement for the school system under study occurred in science: 46% of the students were considered proficient compared to the state average of 67.6% proficiency.

Purpose of the Program Evaluation

In my study, I aimed to analyze the leadership characteristics of principals and how the characteristics influenced science achievement. Education prepares students to be college and career-ready upon completion of the program. Educators design organizational structures to provide programs, resources, and support systems to assist students in being successful and productive citizens. Numerous research studies dating from 2015-to 2020 identified United States students in science ranked 17th compared to other industrialized countries (Daily & Robinson, 2016; Jones et al., 2018; ndunda et al., 2017; Parker et al., 2015). In my program evaluation, I sought to discover obstacles and barriers negating science achievement. John Settlage et al. noted, "school organization and leadership affect student achievement" (2015, p. 382). The summative evaluation resulted in recommendations I provided to the superintendent and assistant superintendent of curriculum and instruction based on the leadership qualities and barriers that impacted science achievement in the school system under review.

Rationale

Science education in the school system under study was in dire need of a program evaluation. The science proficiency average for students in the school system under study was below the proficiency average of other school systems and the state. Nine of the ten elementary schools were scoring well below the state average in science. Additionally, the state placed one of the elementary schools on the state's failing school list based on science scores. The state school improvement specialist indicated several more elementary schools were in jeopardy of becoming failing schools if the principals did not improve the science scores. Several teachers were hired with an alternative teaching certificate and teaching out of their certificated field. Mason and McAlister (2017) reported the majority of the elementary teachers surveyed believed they were unable to conduct science inquiry due to a lack of knowledge or expertise required when teaching science inquiry. Subsequently, teachers who did not have a valid teaching certificate compounded the lack of student progress in science.

I am passionate about providing a quality science education for students in the rural school system under study. While in high school several years ago, many of my daughter's high school teachers nominated her in several areas for a highly respected program sponsored by the governor's office. She elected to apply in the area of science. The application process was stringent as it targeted the top students in the state. During the final step of the application process, the committee required her to be interviewed by a panel of various science teachers in the state's capital city. She exited the interview that day with her head down and in tears. The four-hour drive back to our rural district was gut-wrenching as she wept about being stupid compared to the kids from the state's capital city. From that point, I felt compelled to fight for science education. A child's zip code should not define the quality of education.

Goals

Prior studies have shown inequity in science is based more on political reasons than on teachers' confidence and knowledge (Dailey & Robinson 2016). Therefore, my main goal was to investigate the reasoning for the high percentage of students lacking proficiency on the end-of-year science assessments. The accountability system imposed by the state on this rural school system included science testing in fifth grade. According to Hayes and Trexler (2016), teachers in low-performing schools with high accountability pressure receive less time to teach science. Therefore, the purpose of my evaluation began with analyzing and discovering how principal characteristics affect science achievement using Likert scale surveys and semi-structured interviews.

As a result of my research, I provided recommendations to the superintendent and assistant superintendent of curriculum and instruction based on principal leadership qualities barriers that impact science achievement. Then, I used the issues to guide creating an action plan. Furthermore, I designed a tiered professional development plan to provide training and coaching to offer a superior support structure addressing the needs of the principals and teachers (Kleickmann et al., 2016).

Definition of Terms

- 5E model is a progressive teaching sequence that includes the five stages Engage, Explore, Explain, Elaborate, and Evaluate (Rodriguez et al., 2019).

Research Questions

My primary research questions were:

- What impact does the school principal have on science achievement?

- Which leadership characteristics impact science achievement: experience, leadership style, science background, philosophy, or education in grades 2 -6?

Conclusion

The school system under study has experienced a declining trend in science achievement scores. While the proficiency level for science statewide was 67.7%, in the school system under study, the proficiency level was 46%. Leaders of the school system under study needed to examine factors affecting science achievement to develop a plan of action. The evidence I obtained through the formative evaluation process furnished data to influence classroom instruction, acquisition and distribution of resources, professional development, and student progress in order to build a culture of learning (Patton, 2008).

Chapter Two: Review of the Literature

There is no time in history when science education is more important than today. In 2013, the National Research Council and other science associations developed the Next Generation Science Standards (NGSS) to build students' proficiency and engagement in science. Yet, test scores continue to be an area of concern. The literature review on science education was my attempt to understand the roadblocks impeding the gaps in science education and determine a successful process to overcome them. Over the years, researchers have devoted immense time to assessments, resources, professional development, and science academia which still resulted in little to no improvement in science achievement.

I began the literature review process by scouring the National Louis University library quick start article section. Once in the library, I selected the Elton B. Stephens company host database (EBSCO) platform, which allowed me to conduct Boolean searches with parameters set to search peer-reviewed articles, full text and within the last five years. I ran searches using the phrases: science achievement, improving or lacking science test scores, professional development, and science instructional frameworks.

I stockpiled an enormous number of articles and academic journals throughout the process. My subsequent research strategy was to peruse the articles and keep those about my research interest. I combed through the references cited in the articles as well to allow further investigation into my topic. Then I categorized the literature into areas that comprise the subsections discussed in this chapter.

Proficiency in Science

Educators' recognition of science proficiency as measured by assessments is incommensurate with English/language arts and mathematics. The students took required annual English/language arts (ELA) and mathematics tests, whereas science testing was minimal in the following grade bands 3-5, 6-8, 10-12 (U. S. Department of Education 2020). Jones et al. stated students are not learning the foundations in science education due to the disproportionate amount of instructional time devoted to teaching mathematics, language arts and reading (2019). Twenty-six states collaborated to develop The Next Generation Science Standards (NGSS) to increase the rigor of science academia. The new NGSS standards led to a significant barrier for elementary teachers. The generalist education degree did not prepare elementary teachers for integrating science across multiple content areas (Bowers & Ernst, 2018; Kleickmann et al., 2016). Mason and McAlister (2017) reported that most elementary teachers surveyed believed they could not teach science inquiry due to a lack of knowledge or expertise required when conducting scientific investigations. The low-level preparation in elementary teachers' undergraduate programs to teach science substantially impacted teachers' confidence to engage with the new NGSS (Smith & Nadleson, 2017).

Science instruction at the elementary level is teacher-directed and has an overdependence on outdated science textbooks (Hayes & Trexler, 2016). Castle and Ferreira (2015) reported that teachers' reliance on textbooks and laboratory manuals made students view science as a compilation of science facts and memorization of material. The traditional passive student learning style offered little support in creating connections and understanding of science concepts (DiBiase and McDonald, 2015).

Smith and Nadelson (2017) disclosed elementary students might not participate in inquiry-based science instruction. Even when teachers made opportunities for students to engage in hands-on learning, the teacher-designed labs lacked the complexity and depth to foster new knowledge, as teachers could not connect the scientific inquiry back to the concepts. Teachers need to couple effective teaching practices with practical learning activities (Rieser et al., 2016). Prins et al. (2016) proposed students need meaningful activities, content, and tools for coherency in science education.

Parker et al. (2016) painted a bleak picture of science proficiency in the United States as only 67% of the eighth-graders in the United States (U.S.) scored at the proficient level on science assessments in 2011. Furthermore, the U. S. was ranked 27th in the world for STEM college graduates (2015). Children enter school with a natural curiosity to discover and explore the world. The research by Jones et al. (2018) showed that as students progressed from elementary school through high school, misconceptions and lack of interest in science grew larger, demonstrating a need for science exposure earlier in a student's education. Science education is vital in middle school as students begin to lose interest in science education as they progress through school (Jones et al., 2018; Castle & Ferreira, 2015). The loss of interest in science seems to be confirmed by the many high school students who enroll in only the minimal science courses needed to fulfill graduation requirements (Jones et al., 2018).

The job market demands greater skills and understanding of science, creating a deficit of knowledgeable workers. Blank (2013) mentioned that by 2018 the majority of job openings would require postsecondary education in the realm of Science, Technology, Engineering, and Mathematics (STEM) industries. As students in the United

States continue to lose interest and lack the necessary science skills as assessed on the National Assessment of Educational Progress (NAEP), the projected STEM job market in 2028 will face a 2.4 million job shortage of skilled workers (U. S. Department of Education, 2021). Additionally, low numbers of women and minorities are entering the science and engineering programs compounding the economic importance of the educational pipeline to fulfill STEM industries (Jones et al., 2019, Hayes & Trexler, 2016).

Policy and Practice

In 2002, former President George W. Bush signed the No Child Left Behind Act (NCLB). National leaders used NCLB to require increased accountability to hold schools responsible for academic progress with all student subgroups. In 2015, former President Barack Obama signed the Every Student Succeeds Act (ESSA) (U.S. Department of Education, 2020). As the United States continued to drop in academic standings in comparison to other nations, national leaders used ESSA to require, "for the first time that all students in America be taught to high academic standards that will prepare them to succeed in college and career" (U. S. Department of Education, 2020).

Educational policies began to be a hot topic for policymakers to call the action on the American educational systems (Blank, 2013). State and federal policies have increased the assessment and accountability of test scores since 2001 and again in 2015. Time allotted to teaching science academics in elementary schools had dwindled with an increased focus on English language arts and mathematics. The National Science Teachers Association (NSTA) declared schools needed to give science learning equal priority as other subjects and strive for 60 minutes of science instruction daily (NSTA, 2019). The National Research Council argued that accountability and assessment in science were essential to provide adequate instructional time devoted to science (Blank, 2013). The increased responsibility limited teachers' ability to follow students' interests and curiosity. Hayes and Trexler (2016) pronounced, "research demonstrated that accountability pressure primarily harmed elementary science education in general and inquiry, or hands-on, pedagogies especially" (p. 270). There was a disconnect between developers and promoters of reform who focused on theory and educators tasked with the practicality of implementing the ideas, resulting in challenges for the reform (Smith and Nadelson, 2017).

Researchers demonstrated an opportunity gap between student population groups. Miller et al. (2015) confirmed in their study that exclusion of science professional development (PD) contributed to propagating intellectual poverty among students, significantly lower socioeconomic students, and those who were English Language Learners (ELL). Parker et al. (2015) reported groups of students were being left behind in science as White and Asian/Pacific Islanders outperformed Black and Hispanic students. In high poverty areas, the evidence disclosed that opportunities for inquiry-based activities were lacking. Inequities in students' exposure to high-quality science education may limit the ability of students to participate in a rapidly developing society (Hayes & Trexler, 2016). Jones et al. (2018) demonstrated science should be a concern as the United States continued to dwindle in standings among the rest of the world as mathematics, reading, and language arts received priority over science.

Professional Development

Teacher quality is considered the lynchpin on which student learning hinges (Miller et al., 2015). Educator gaps widen with increased expectations for science education, capabilities of content knowledge, and pedagogical knowledge. Smith and Nadelson (2017) suggested that professional development practices begin with teachers' current approaches to build upon existing knowledge. Professional development (PD) is critical to reforming science education; however, the literature is mixed on which delivery method is ideal. According to Miller et al. (2015), professional development needs to encompass content knowledge development, teacher belief systems, and school content practice. Dailey and Robinson (2016) identified a two-pronged approach to professional development, mentioning summer institutes and job-embedded coaching, which amended teachers' concerns but did not eliminate educators' concerns with teaching science.

Throughout my years in education, I have witnessed teachers attending a one-time sit and get professional development. Then they are expected to implement what they learned with high proficiency levels in the classroom. The one-and-done professional development experience creates frustrations for teachers, which results in a low level of transfer to the learning experience. Guzey et al. (2016) specified attending professional development did not equate to implementing practices learned. It is not easy for teachers to transfer learning derived from professional learning opportunities into routine daily practice. The authors of one professional development model recommended training highly effective teachers with extensive professional development strategies to support teachers in their home schools in an ongoing manner (Green & Kent, 2016). Lee and

Glass (2019) called for teacher preparation programs to develop methods courses specializing in elementary science concentration. The traditional approach does not allow time to address the varying pedagogical approaches to teaching science.

As teacher quality is a leading factor for student achievement, it is imperative to find an approach to maximize teacher learning and effectiveness. According to the research, educators are provided professional development opportunities through multifaceted approaches, with only minor changes recorded (Dailey & Robinson, 2016; Green & Kent, 2016; Keller & Pearson, 2012; Lee & Glass, 2019; Miller et al., 2015). Professional development is a complex and intricate activity for teacher development. The teacher must be encouraged and supported to implement the training they received at the building level for the exercise to impact positively the teacher's ability to teach. Keller and Pearson (2012) proposed, "Professional development is one approach; encouraging and incentivizing cross-disciplinary collaboration and coordination at the school level is likely to aid in this effort" (p. 17). Dailey and Robinson (2016) noted that teachers who received initial training remained concerned about implementing the activity. Professional development training provided to teachers had little impact on student instruction unless leaders sustained the training, including hands-on learning opportunities, combined it with teachers' daily responsibilities, and involved group work (Green & Kent, 2016). Parker et al. (2015) noted PD should be sufficient enough to support content and pedagogical changes. Gone are the days of the one-day professional development training. Thus, it is critical to provide differentiated PD activities to accommodate and address teachers' needs (Guzey et al., 2016).

Burns et al. (2018) investigated the professional learning community (PLC) model, focusing on student data, collaboration, and learning. Recent research found the professional learning community model increased pedagogical, content knowledge, and student learning (Burns et al., 2018). Teachers in PLCs focused on critical issues surrounding student learning leading to modification of classroom instruction (Burns et al., 2018). The research of ndunda et al. (2017) showed collaboration and teamwork practices involved within PLCs demonstrated positive outcomes for professional development for teachers. Moreover, studies showed PLC embedded PD effectively improves both the teaching and learning process (ndunda et al., 2017). Science teachers who participated in the PLC process indicated their students were twice as likely to perform proficiently on state assessments (Burns et al., 2018). However, there is limited research regarding PLCs in K-12 schools improving student performance in science.

Administrator Focus

Research repeatedly demonstrated how school organizations and exerted leadership produced an observable and monumental influence on student outcomes. Principals who allocated more time to developing the educational needs of teachers, educational programs, and conducting evaluations showed significant improvement over time in student achievement (Settlage et al., 2015). Classroom teachers felt constraints based on the daily schedule, the number of standards, curricular demands, and class size impeded their ability to implement inquiry-based science lessons (DiBiase and McDonald, 2015; Hayes and Trexler, 2016). Miller et al. (2015) reported that continually increased pressure on teachers to focus on English language arts and mathematics resulted in a decrease or elimination of science instruction in the elementary grades.

According to teachers surveyed, PD had significantly diminished, especially in science, due to budgetary constraints(Miller et al., 2015). Some studies showed school system funds and materials were inadequate, with teachers reporting they needed to spend their own money on supplies (Hayes & Trexler 2016). Teachers were reluctant to practice newly adopted instructional materials unless administrators provided instruments and resources to support classroom instruction (Keller & Pearson, 2012). In 2011, the federal government provided billions of dollars in funding for states to create a comprehensive state-level STEM strategy. State programs were to guide K-12 STEM education, increase student performance in STEM, and integrate the STEM content (Parker et al., 2015). Numerous studies suggested that although teachers attended PD and felt competent in teaching science, they lacked the time and resources to teach science effectively Parker et al., 2015). Teachers must cover a certain amount of material for mandated assessments, so they often replace inquiry-based instruction with teacher-directed instruction methods (DiBiase & McDonald, 2015). Inquiry-based lessons allow students to study scientific concepts, develop questions, and explain the evidence. One example of scientific inquiry is the 5E-model of engaging, exploring, explaining, elaborating, and evaluating. The teacher-directed model does not allow students to engage in the 5E model as it tells students about science rather than allowing them to experience science (DiBiase & McDonald, 2015). However, Alonzo and Ke (2016) argued that assessments provide excessive information on students' recent achievements, allowing the teachers to adjust teaching and learning to target students' needs.

Jones et al. (2018) stated school leaders need to provide resources to support science investigations, professional development to help teachers understand the investigative process, and funds to purchase supplies. Some researchers blamed school districts, stating a lack of explicit expectations on the science curriculum and its implementation. (Jones et al., 2018). Miller et al. (2015) exposed that state-sanctioned PD and instructional conformity of classroom-level instruction across schools became more prescriptive as achievement levels declined. School leaders need to be at the forefront of science education as the organizational structure and leaders within the system substantially influence science achievement.

Conclusion

In conclusion, the literature reviewed during my research illustrated clear themes resulting in the decline of science achievement: proficiency in science, policy, practice, professional development, and administrator focus. Overwhelmingly, the research focused on teacher quality as a leading factor in addressing science achievement. However, structures established by administrators such as lack of funding, inadequate time devoted to science, and a lack of resources impeded successful teaching practices. Accordingly, the leaders in the United States government decided to institutionalize accountability by signing laws requiring schools to demonstrate adequate yearly progress (AYP), mainly in English language arts (ELA) and mathematics (Haynes & Trexler, 2015). Consequently, English/ language arts and mathematics dictate the instructional day at the elementary level. Although various factors contribute to a student's performance, time devoted to science instruction at the elementary level makes a difference. It will enable teachers to lead inquiry-based lessons so students can grapple with the science content (Blank, 2013).

Organizational structures imposed on classroom instruction have ramifications on student performance. Therefore, allocated resources, such as professional development to support science instruction, are reallocated or reduced to provide support in other content areas. Teachers who participated in PD showed increased confidence and understanding of science content and pedagogy. However, the types of PD to improve teacher quality and student performance are vast. Therefore, my research investigated the impact of a brief science program on science academics.

Chapter Three: Methodology

My mixed-method study aimed to determine which leadership characteristics influenced science achievement in a rural school system. I gathered data from science teachers, elementary principals, and one middle school principal. The mixed-method design allowed me to collect quantitative, qualitative, and extant science data. The data collection allowed me to triangulate multiple data points to thoroughly investigate the leadership characteristics of principals and the impact on science achievement.

Research Design Overview

Nine of the 10 elementary schools' science achievement scores fell below the state achievement levels in the school system under study. John Settlage et al. noted, “School organization and leadership affect student achievement” (2015, p. 382). Through my study, I aimed to analyze the leadership characteristics of principals and how the characteristics influenced science achievement. I used a summative assessment (Patton, 2008, p. 114) to gather data to render a list of recommendations to the superintendent and assistant superintendent of curriculum and instruction based on the leadership qualities of principals and the removal of barriers that impact future science achievement.

I used a mixed-methods research design to collect qualitative and quantitative data. I collected qualitative data through semi-structured interviews held with principals. I surveyed teachers and principals to collect quantitative data. I collected extant data from end-of-year science assessments. The combination of quantitative and qualitative data portrayed a more precise depiction of reality and the need for a systematic change (Wagner et al., 2006, p 146).

Participants

There were two stakeholder groups in this study: science teachers in grades 2-6 and principals of elementary and middle schools. There were 102 science teachers in grades 2-6 during the 2020-2021 school year. Out of 102 science teachers, 39 agreed to participate in the survey.

During the 2020-2021 school year, there were 12 possible principal participants. Of the 12 potential participants, nine elementary school principals and one middle school principal agreed to participate in the survey and interviews. The information gathered from the surveys and interviews provided me with a broad perspective of leadership characteristics ranging from elementary to middle school.

Data Gathering Techniques

I used a mixed-methods research design of extant data and data from Likert scale surveys and semi-structured interviews. First, I exported the extant data from the state public website. Second, I utilized Google forms to create and send surveys to principals and teachers. Finally, I used Google Meet in conjunction with Google Meet Transcripts to conduct the semi-structured interviews. The Google Meet Transcript provided a word-by-word dictation by speaker and minute.

Teacher Survey

I developed a Likert scale survey for teachers (see Appendix A). I invited 150 teachers to participate in the survey. Of the 150 teachers, 39 teachers completed it. The survey had 12 statements on a 4-point scale. The teachers' responses to these statements provided me with information on the teachers' preparation to teach science, the teachers' confidence in teaching science, the current science instructional resources, and their opportunity to participate in science professional learning. Their responses also provided information on their principal's focus on science, and their feedback on science instructional practices.

Principal Survey

I developed a Likert scale survey for principals (see Appendix B). Eight principals completed the survey. The survey had 17 questions with a 4-point scale. I created the questions on the survey to elicit data on the principal's educational background, philosophy, leadership style, and educational emphasis.

Principal Interview

I conducted nine semi-structured interviews with the elementary and middle school principals (see Appendix C). I developed principal interview questions that focused on leadership style, leadership experience, and leadership priority in budget and schedule. The semi-structured interview allowed me to probe further using a conversational style setting to elicit an in-depth understanding of actions imposed by the principals. Furthermore, I used the interviews to provide a deeper understanding of how the building-level principal's leadership followed the actions of the system-level leaders. I intentionally designed the interview questions to determine which leadership style affected science achievement.

Extant Data

I compared two years of quantitative data I gathered from the state website from 2018-2019 and 2020-2021. The school system did not participate in testing during the 2019-2020 school year due to the COVID-19 pandemic. However, the state-mandated all fifth-grade students to participate in the end-of-year science assessments in 2020-2021.

The local school systems had the flexibility of administering the end-of-grade assessments as the state provided a testing window from Mid-April until May 28, 2021. Therefore, the fifth-grade students in the system under study participated in the science assessment in mid-May. The fifth-grade science assessment assessed the students' mastery of earth science, physical science, and life science. However, the state calculated the weight of each domain differently based on the amount of suggested instructional time to teach the domains: Life Science 42%, Physical Science 35%, and Earth Science 23%. Therefore, Life Science takes up most of the instructional weeks and the tested items on the state assessment.

Data Analysis Techniques

I collected data from science teachers in second through sixth grade using a Likert scale survey. The Likert scale survey allowed me to quantify the data by an ordinal measurement scale which used a ranking and ordering by questions (Carroll and Carroll, 2002). The data gathered allowed me to compare the perception data with the results of the principal's survey. I focused on the strongly disagree and disagree responses of the teachers' data. I assigned themes based on the results of the data gathered.

In addition, I collected survey data from elementary and middle school principals. I used a Likert scale survey to quantify the results and look for reoccurring themes throughout the answers. The survey questions were similar to the teachers' survey questions to compare the results. I analyzed the results by focusing on the discrepancies between the teachers' and principals' surveys. I identified themes from the analysis of the results.

I conducted semi-structured interviews with the elementary and middle school principals. The semi-structured interviews were held through Google Meet and recorded using the extension application Google Meet Transcripts. I used the recorded interviews to gather a more comprehensive understanding of the principals' responses. After completing all principal interviews, I analyzed the responses to discover themes and patterns according to the leadership characteristics: experience, leadership style, science background, philosophy, and education. The survey responses provided a deeper insight into the principals' leadership perception of science instruction. It brought attention to the principals' thought process behind the actions they applied to science instruction (Patton, 2008).

I collected extant data from the state's website to compare the science achievement scores by school. Collecting the quantitative end-of-grade science assessment data, I focused on whether the school increased the number of students scoring proficient and above on the end-of-grade science assessment. Specifically, I analyzed how the science scores related to the perception data obtained from the principal and teacher survey results.

Ethical Considerations

I included all elementary and middle school principals in the research study. I obtained written permission from the superintendent and the assistant superintendent of curriculum and instruction to collect qualitative and quantitative data. Once granted permission, I sent emails to both teachers and administrators inviting them to participate in the study. The email consisted of a detailed explanation describing all participants were unidentifiable in the data gathered. The interviews were assigned a number for tracking purposes when transcribing to protect the identity of the participants.

Limitations

One limitation of the study was the small sample size of participants. The system under study was a small rural school system with ten elementary schools, one gifted resource center, and one middle school. Two schools had principal vacancies all year. The board of education for the school system under study chose not to fill the vacancies until the appointment of the new superintendent in March of 2021. Then one elementary principal was non-reappointed to the principal position due to board members voting to non-renew the contract against the current superintendent’s recommendation. This principal asked the school system leaders to be removed from the school as the teachers no longer listened to his directions. Therefore, there was no instructional leadership for science at the school for three months.

Another limitation was that the study occurred during a global pandemic, which could have resulted in unusual circumstances for the science teachers and the building principals. The system under study struggled with constant quarantines of staff and students, a complete system shut-down due to a lack of people able to work, and the use of remote learning. Therefore, professional learning and a strong instructional focus were not the primary focus of the school system leaders or the building principals. The pandemic resulted in many building principals and science teachers operating differently as they moved from brick and mortar to virtual learning. The school system and school level funding were directed towards online platforms and technology to support virtual learning. The system under study focused on providing safe and orderly environments with constant attention to cleaning the buildings for returning staff and students.

Conclusion

I collected quantitative, qualitative, and extant data in my study. In my research, I analyzed data gathered on science assessment results from the end-of-year state assessments in 2018-2019 and 2020-2021. I developed a list for the superintendent and assistant superintendent of the curriculum of leadership characteristics to increase student achievement based on the data collected from state assessments, teacher surveys, principal surveys, and interviews. The data collected from the study provided an overall understanding of the principals' leadership characteristics and how they impacted science achievement.

Chapter Four: Results

The results in this section provide interpretations to questions about how principals' leadership characteristics influence science achievement. I analyzed and compared teacher responses on Likert scale surveys to the building principals' Likert scale survey responses. Themes and trends arose from the data analysis from the semi-structured interviews I conducted with the building principals. I collected extant data from the Spring of 2019 and Spring of 2021 end-of-year science assessments found on the State Department of Education website to study and analyze. I could not obtain student assessment data for Spring 2020 due to the state not mandating testing because of the COVID-19 pandemic. The data collected was surprising but may be used to provide guidance and professional learning in the school system under study. I maintained an objective mindset while collecting the data from the participants.

Findings

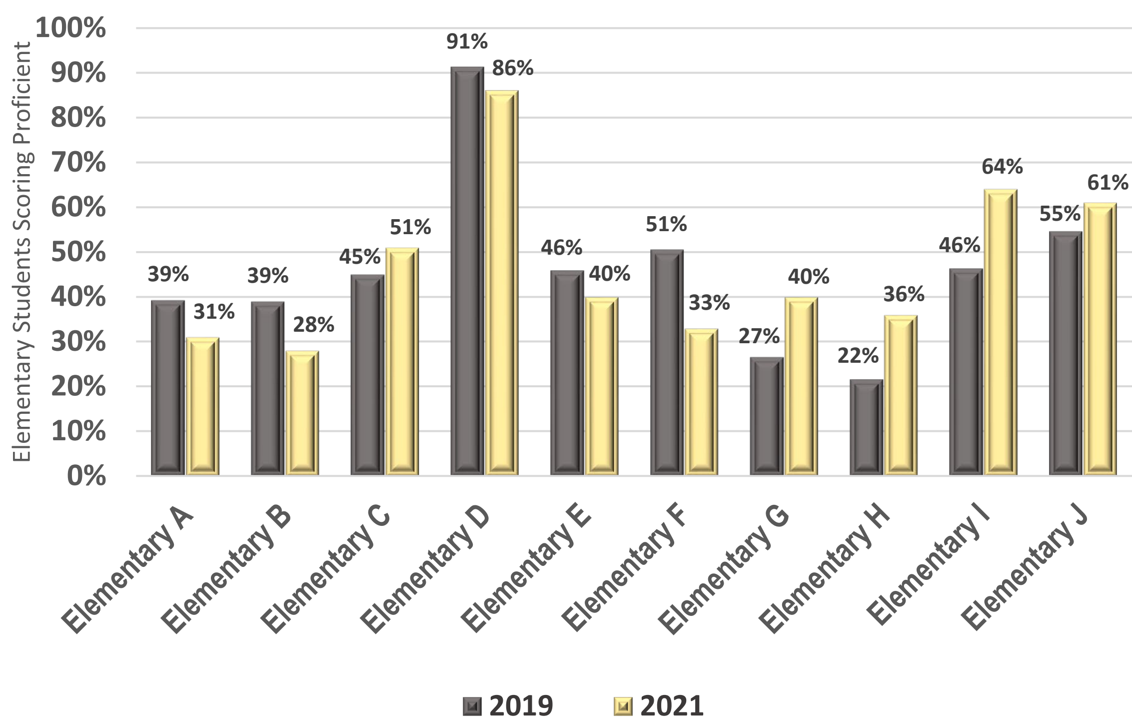
My findings in the study consisted of triangulated data from four data points: extant data, Likert Scale Surveys from science teachers in second through sixth grade, Likert Scale Surveys from principals of elementary and middle schools, and semi-structured interviews with principals. I pulled the end-of-year science assessment results for 2019 and 2021 from the state's department of education website. Due to the national pandemic, I could not gather data from 2020 as the state did not require testing. I sent surveys using Google Forms to 150 science teachers, and 39 of the teachers completed a survey. Ten principals received surveys using Google Forms, and eight responded. The results of the data collected are provided below in this chapter.

Extant Data

The state for the school system under study released science achievement scores in 2018-2019. In the system under study, 46% of the students were considered proficient in science compared to the state's average of 67.6% proficient. The state identified one of the 10 elementary schools in the school system under study as a critically performing school due to poor performance on the end-of-year science assessment. Figure 1 shows the comparison of students scoring proficient on the end-of-year science assessment by schools from 2019 to 2021.

Figure 1

Elementary Science Weighted Performance 2019 vs 2021



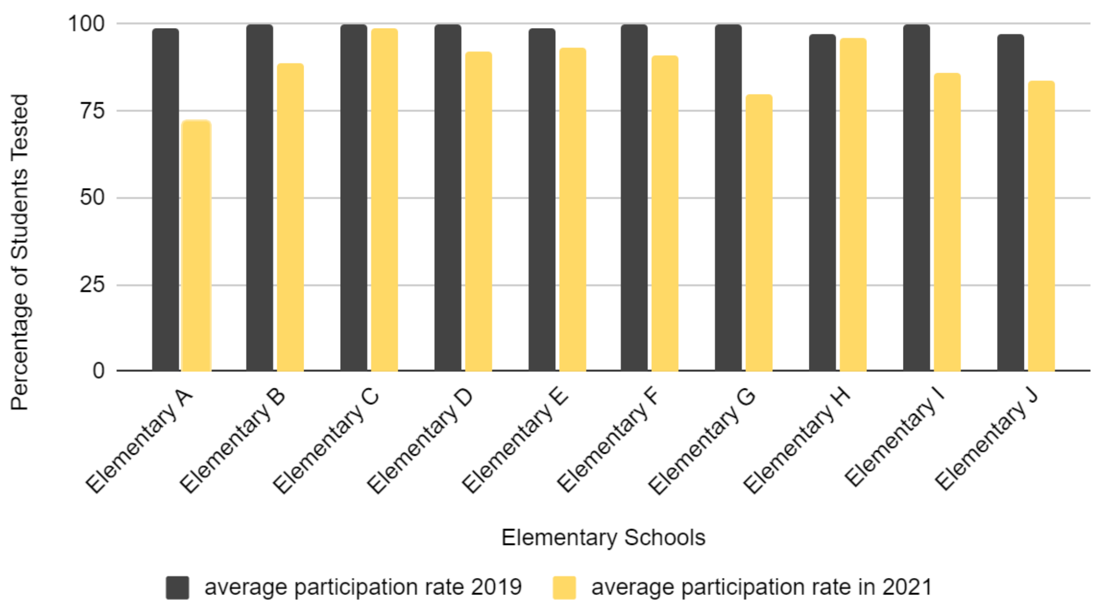
Individual achievement scores showed increases and decreases; however, the school system reported a 1% gain in achievement. Science achievement scores dropped during the 2020-2021 school year as student achievement fell to 30% of the students scoring proficient. Five elementary schools showed improvement, and five elementary schools had a decline in test scores. Schools with decreased scores were Elementaries A, B, D, E and F. Elementary A showed an 8% decline in science achievement. Elementary B, where the principal retired in December 2020, established an 11% decline in science achievement. Elementary D showed a 5% decline in science achievement. Elementary E showed a 6% decline in science achievement. Elementary F showed an 18% decline in science achievement.

Elementary C, G, H, I, and J showed an increase in scores. Elementary C showed a 6% increase in science achievement. Elementary G, where an acting veteran principal replaced the principal in August of 2020, showed a 13% increase in science achievement. Elementary H showed a 14% increase in science achievement. Elementary I showed an 18% increase in science achievement. Elementary J showed a 6% increase in science achievement.

These scores need to be carefully considered based on the percentage of students tested. In 2021 the state for the system under study, released COVID-19 testing guidance stating that schools should not require students in remote learning to come back into the school buildings to take the end-of-year assessments. Therefore, the participation rate at each school could have impacted the data as all ten elementary schools had a decline in student participation at the end of the grade state assessment. Figure 2 shows the comparison between the school years 2019 and 2020 in the average number of students who participated in the state end-of-year science assessment.

Figure 2

Average Participation Rate Percentage 2019-2021



Survey Data

I used Google Forms to send a Likert Scale Survey to science teachers in grades 2-6 and elementary and middle school principals. Google Forms allowed for a quick and accurate collection of the data. To ensure each respondent's responses were confidential, I did not collect their email addresses. Also, I enabled the button so each respondent could only answer once. I needed to ensure the teachers and principals did not submit multiple forms.

Teacher Surveys. To investigate one of my primary research questions: What impact does the school principal have on science achievement? I used a Likert scale to conduct surveys targeting science teachers in Grades 2-6, including elementary and middle school principals. It is one of the most common uses of ordinal scaling for ratings

(Carroll and Carroll, 2002, p. 11). I sent surveys to 150 science teachers in Grades 2-6 (See Appendix A). Out of the 150 science teachers, 39 science teachers responded.

In item 1, I asked teachers to respond to the statement: I feel confident in teaching science. According to the data, 38 out of the 39 teachers agreed or strongly agreed to feeling confident in teaching science. However, there was one participant who disagreed with the statement. (See Figure 3)

Figure 3

Survey Statement One: I Feel Confident Teaching Science

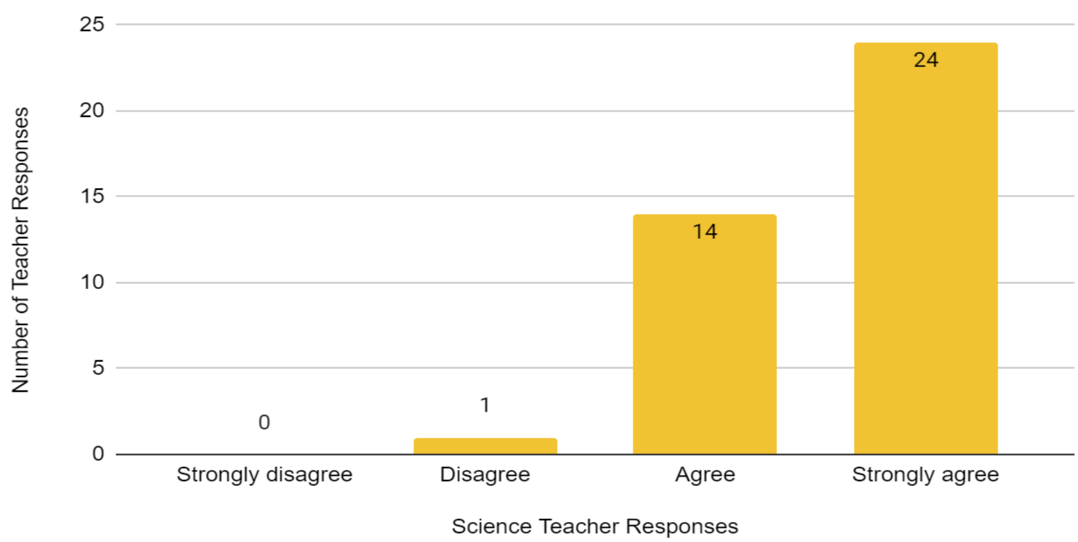


Figure 4 shows that 20 of 39 teachers agreed or strongly agreed with the statement: The principal has provided me with science training. There were 19 of the 39 science teachers who disagreed or strongly disagreed that the principal provided them with training in science.

Figure 4

Survey Statement Two: The Principal has Provided Me with Science Training

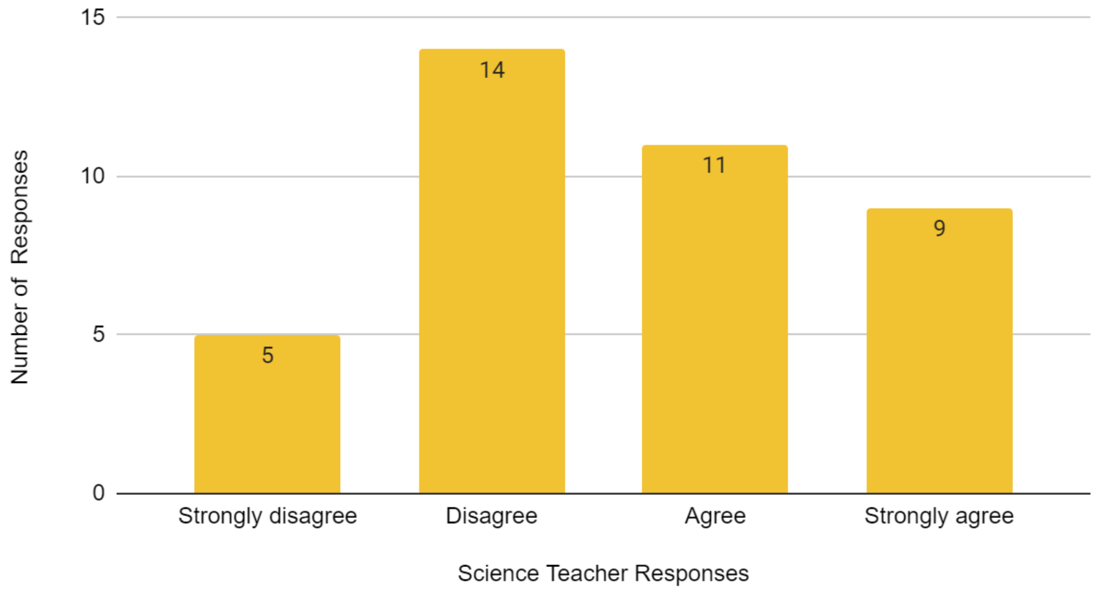


Figure 5 reflects the participants' responses to the statement: My undergraduate education provided the necessary background knowledge in science to teach the required science curriculum adequately. Among the 39 teachers who responded, 31 said their undergraduate degree provided the necessary background to teach science adequately. However, eight science teachers strongly disagreed that their undergraduate degree provided the necessary background to teach the required science curriculum adequately.

Figure 5

Survey Statement Three: My Undergraduate Education Provided the Necessary Background Knowledge in Science to Teach the Required Science Curriculum Adequately

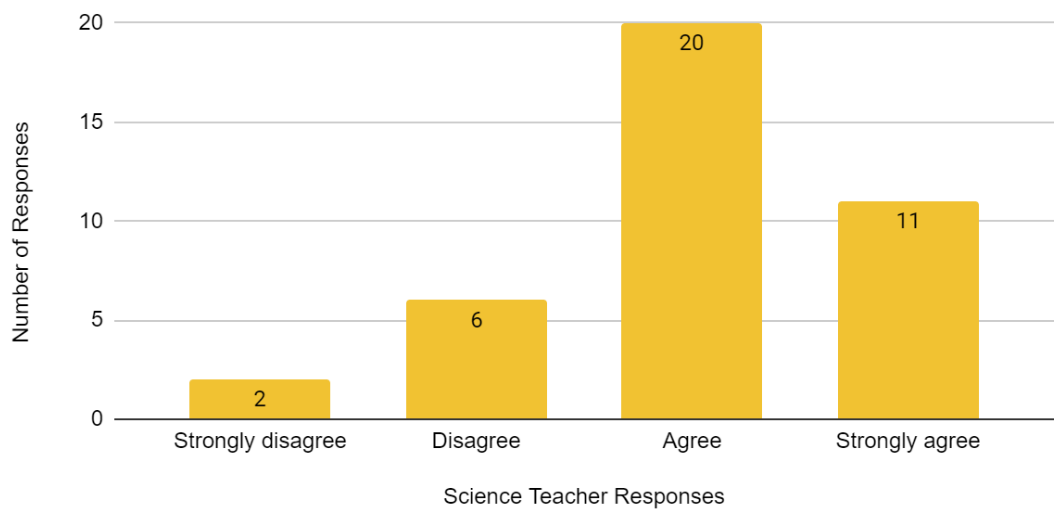


Figure 6 reflects the science teachers' responses to the statement: I teach science daily at my school. The data revealed that 36 of the 39 science teachers strongly agreed that they teach science daily at school. Only 3 out of 39 science teachers disagreed they teach science daily at school.

Figure 6

Survey Statement Four: I Teach Science Daily at My School

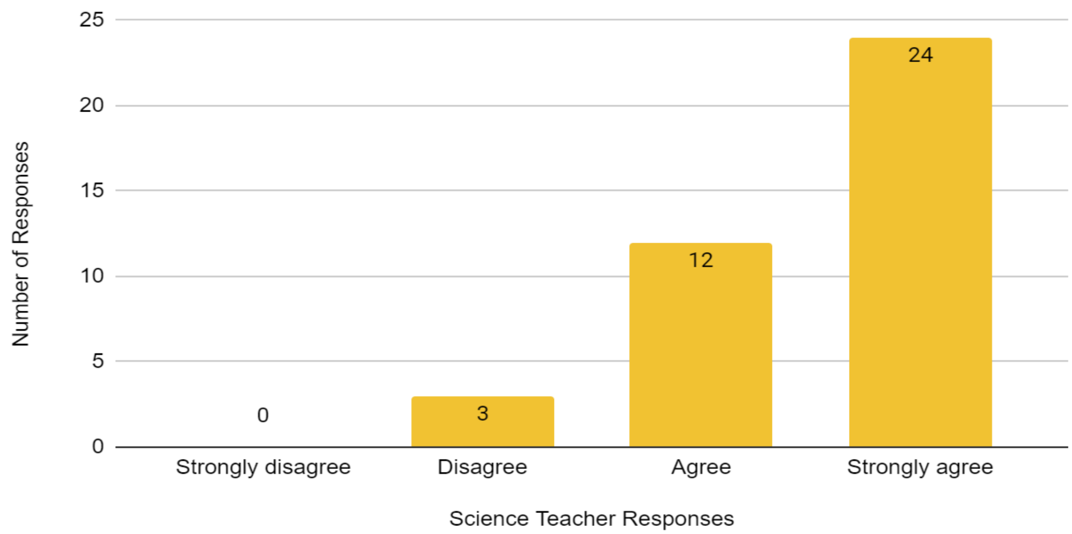


Figure 7 reflects the science teachers' responses to the statement: My principal considers science as important as reading and math. The results demonstrated that 24 teachers out of 39 agreed or strongly agreed that the school principal considered science as crucial as other content areas. Among the 39 teachers who responded, 15 disagreed or strongly disagreed that the principal considered science as important as reading and math.

Figure 7

Survey Statement Five: My Principal Considers Science as Important as Reading and Math

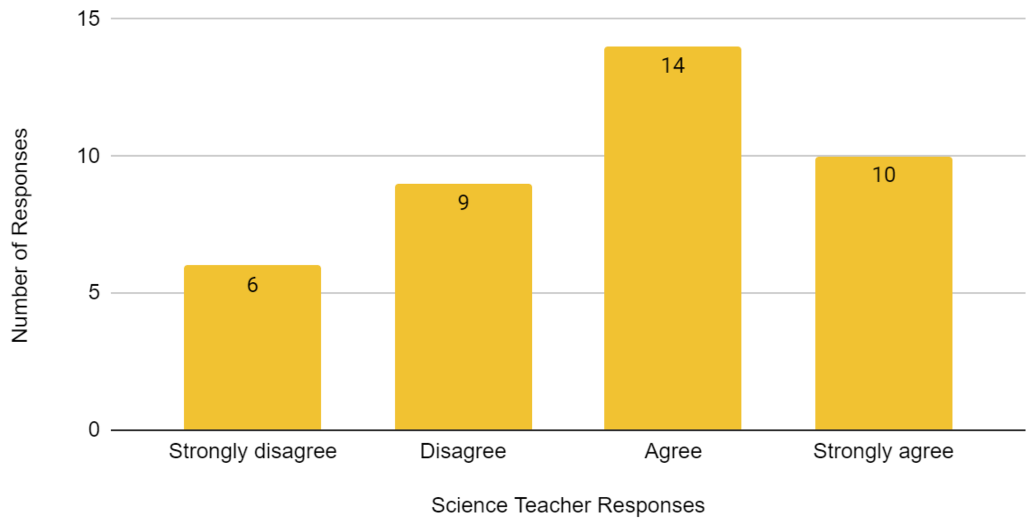


Figure 8 depicts the science teachers' responses to: I have updated science materials. Seventeen out of 39 science teachers strongly agreed or agreed they had updated science materials. According to my results, 22 out of 39 science teachers strongly disagreed or disagreed they had updated science materials.

Figure 8

Survey Statement Six: I have Updated Science Materials

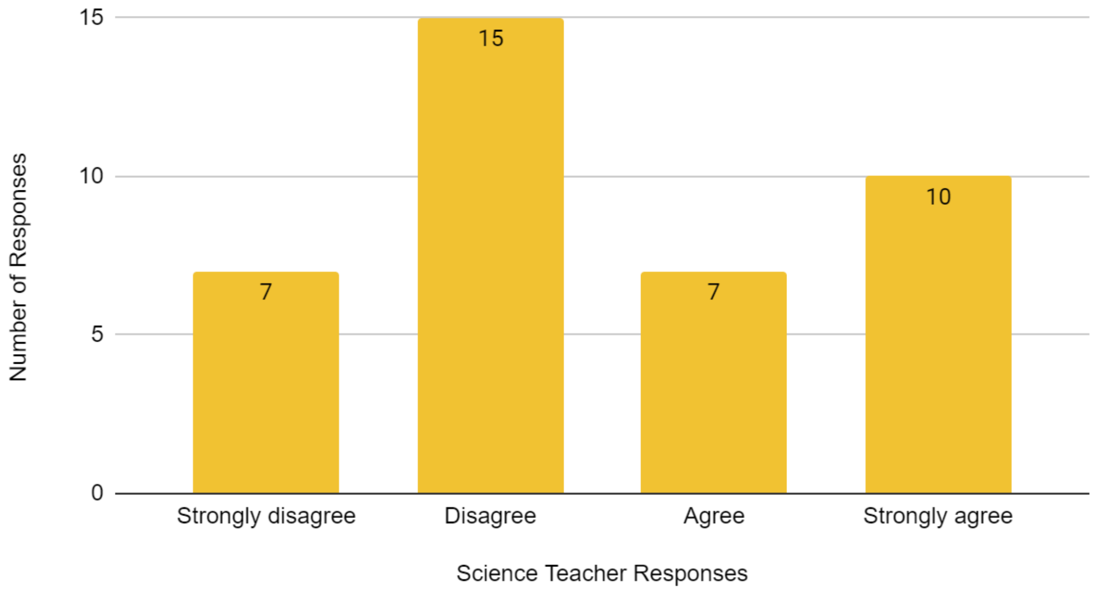


Figure 9 demonstrates the responses to the statement: I have lab equipment and materials to conduct experiments. The results indicate that 21 out of 39 science teachers strongly agreed or agreed they had lab equipment and materials to conduct experiments. Eighteen out of the 39 science teachers strongly disagreed or disagreed that they had lab equipment and materials to conduct experiments.

Figure 9

Survey Statement Seven: I have Lab Equipment and Materials to Conduct Experiments

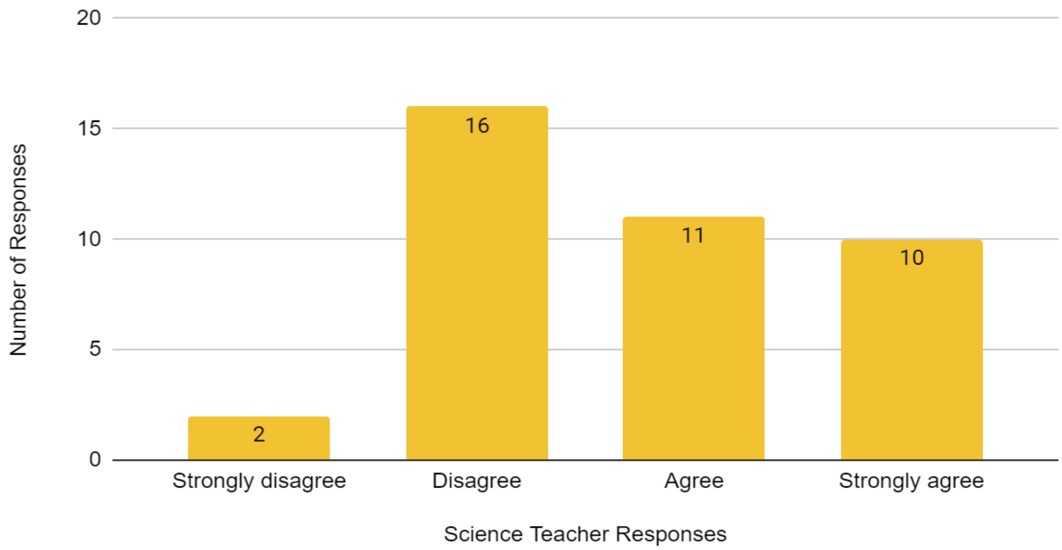
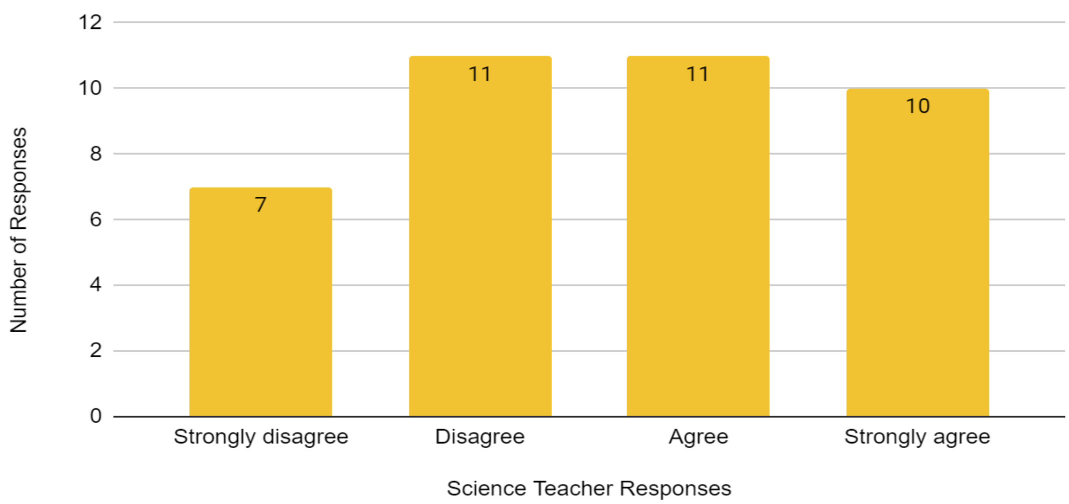


Figure 10 depicts the science teachers' responses to: My principal holds professional learning communities centered around science. The results showed that 21 out of 39 science teachers strongly agreed that the building principals had professional learning communities centered around science. Eighteen out of 39 science teachers strongly disagreed or disagreed the building principal held professional learning communities centered around science.

Figure 10

Survey Statement Eight: My Principal holds Professional Learning Communities Centered Around Science



In Figure 11, I depict the responses to the following statement: Science goals are created for my school. Twenty out of 39 science teachers strongly agreed that science goals were created for the school. Nineteen out of the 39 science teachers strongly disagreed or disagreed that science goals were established at the school. There was no significant difference between agreeing or disagreeing as there was a one respondent difference between the agree/disagree groups.

Figure 11

Survey Statement Nine: Science Goals are Created for my School

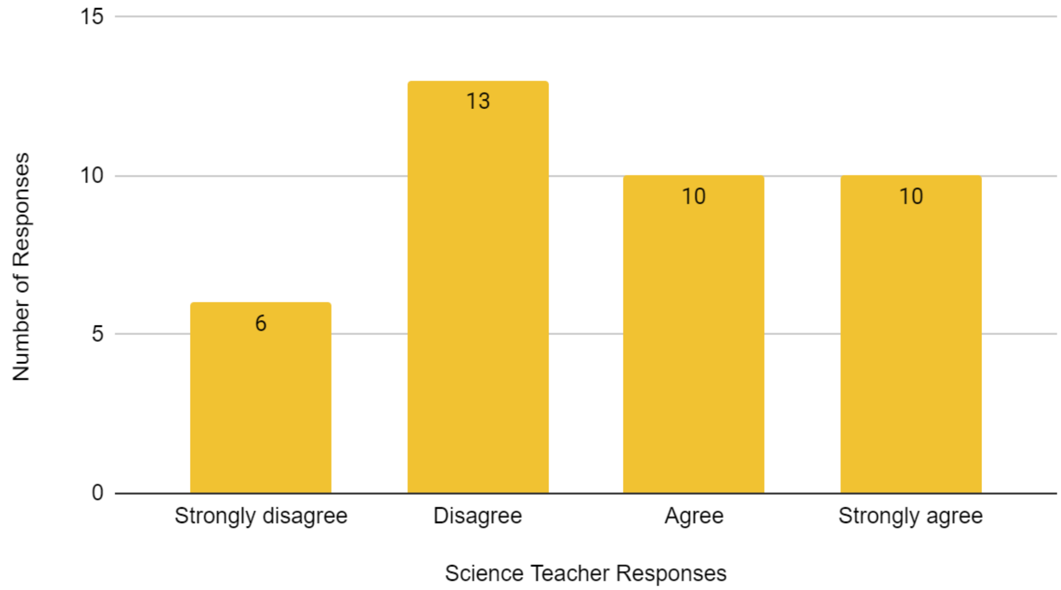


Figure 12 displays how science teachers responded to the statement: My principal emphasizes science education. Out of 39 science teachers, 17 strongly agreed or agreed the principal emphasized science education. Twenty-two out of 39 science teachers strongly disagreed or disagreed the principal emphasized science education.

Figure 12

Survey Statement Ten: My Principal Emphasizes Science Education

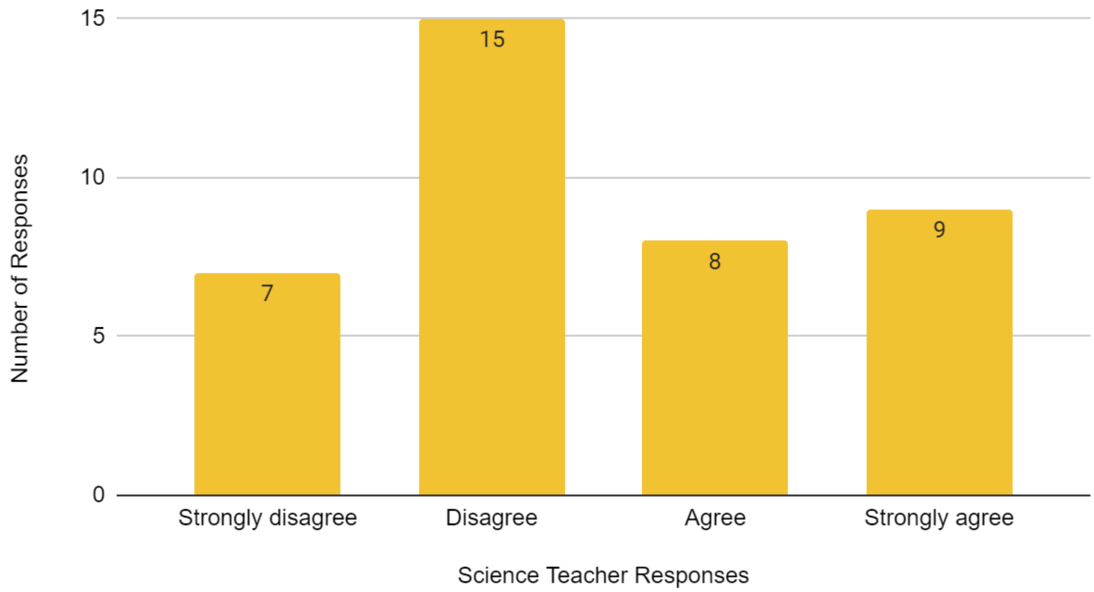


Figure 13 displays how science teachers responded to the statement: My principal observes science lessons in my classroom. Twenty-six of 39 science teachers strongly agreed or agreed the principal observed science lessons in the classroom. However, 13 of 39 science teachers strongly disagreed or disagreed with the statement that the principal observed science lessons in their classroom.

Figure 13

Survey Statement Eleven: My Principal Observes Science Lessons in My Classroom

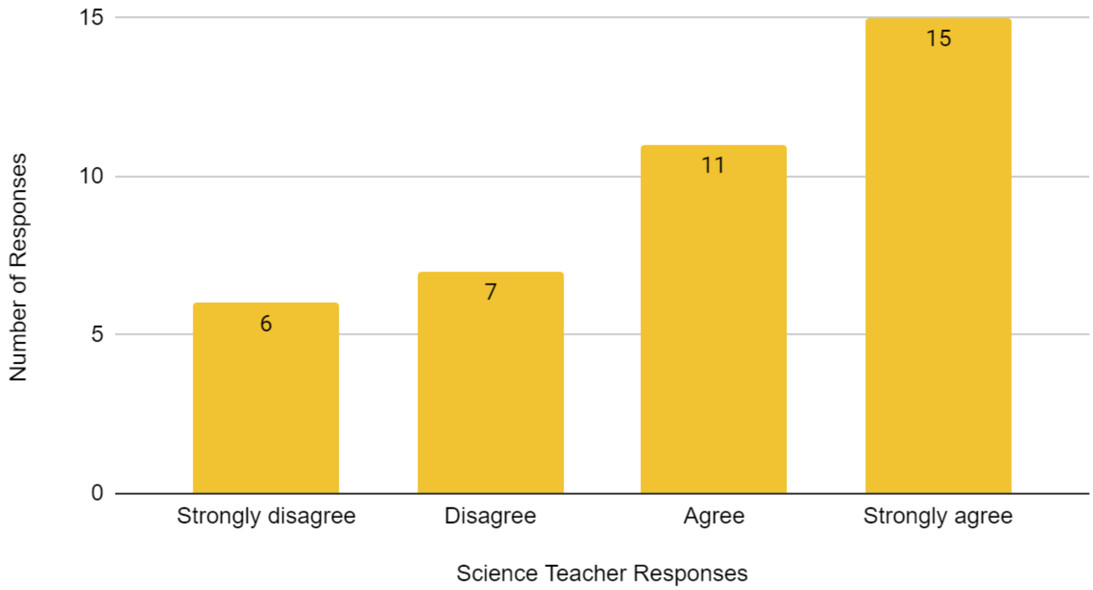
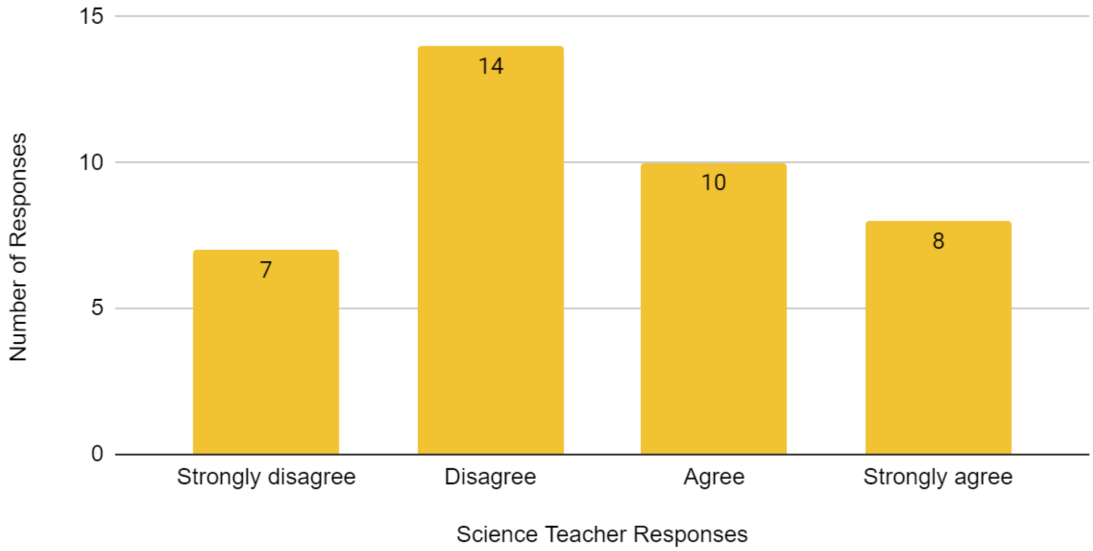


Figure 14 shows how science teachers responded to the statement: My principal provides feedback and suggestions directly related to the science teacher's instruction. The data showed that 18 of 39 science teachers strongly agreed that the principal provided feedback and suggestions directly related to the science teacher's instruction. Whereas 21 of 39 science teachers strongly disagreed or disagreed that the principal provided feedback and suggestions directly related to the science teacher's instruction.

Figure 14

Survey Statement Twelve: My Principal Provides Feedback and Suggestions Directly Related to the Science Teacher's Instruction



Principal Surveys. I surveyed ten elementary principals and one middle school principal using a Likert Scale instrument (See Appendix B). I chose the Likert scale to gather a perspective built on the principals' assumptions, habits, and perceived beliefs projected into reality. In addition, it provides a normative outcome since a long existential study is not practical (Patton, 2008, p. 423). I collected responses from eight out of the ten elementary and middle school principals. Seven elementary principals and one middle school principal responded.

Figure 15 shows the principal's response to the statement: I have experience teaching science. Six of the eight principals strongly disagreed or disagreed they had experience teaching science. Two of the eight principals strongly agreed they had experience teaching science.

Figure 15

Survey Statement Thirteen: I Have Experience Teaching Science

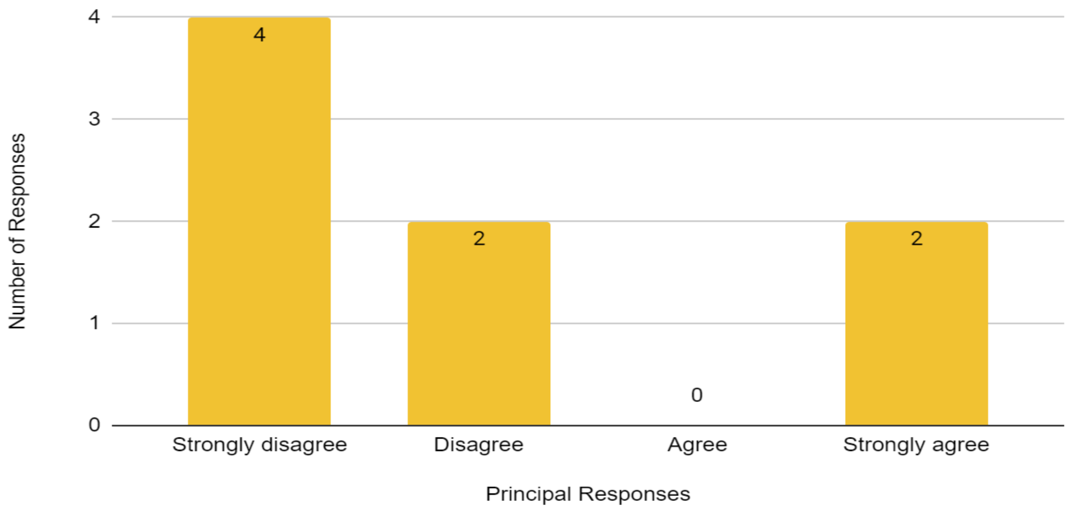


Figure 16 shows the principal's response to the statement: I have attended science training in the past year. Seven of the eight principals strongly disagreed or disagreed they had participated in science training in the past year. One of the eight principals responded they strongly agreed they had attended science training in the past year.

Figure 16

Survey Statement Fourteen: I Have Attended Science Training in the Past Year

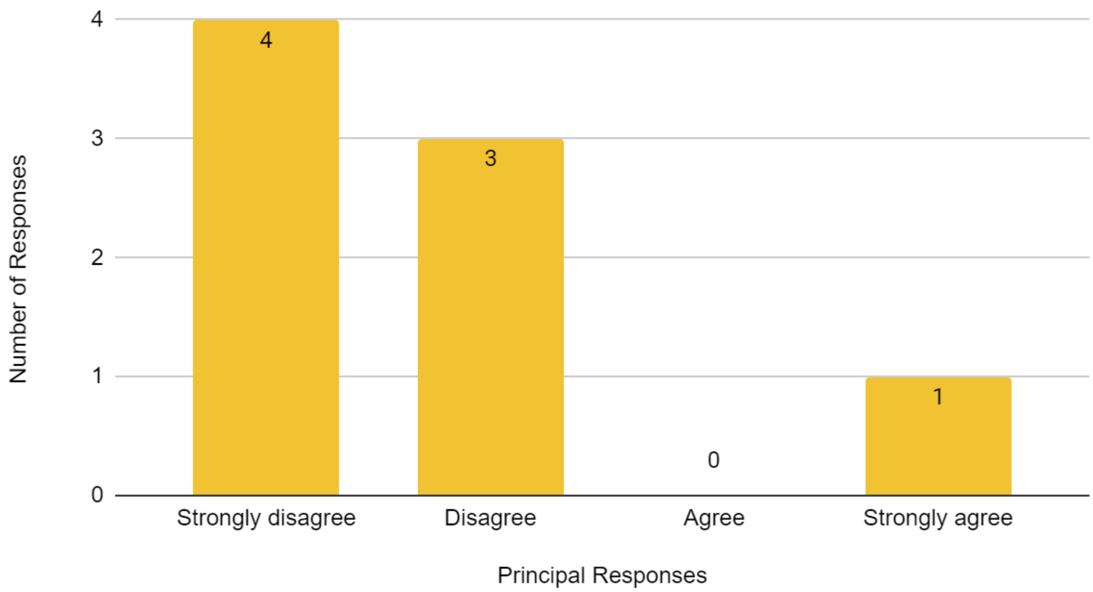


Figure 17 shows the responses to the statement: Science is an essential part of the school curriculum. All eight principals who responded to the survey strongly agreed that the science curriculum is an essential part of the school curriculum. The results indicate no principal felt science was not necessary to the school curriculum.

Figure 17

Survey Statement Fifteen: Science is an Essential Part of the School Curriculum

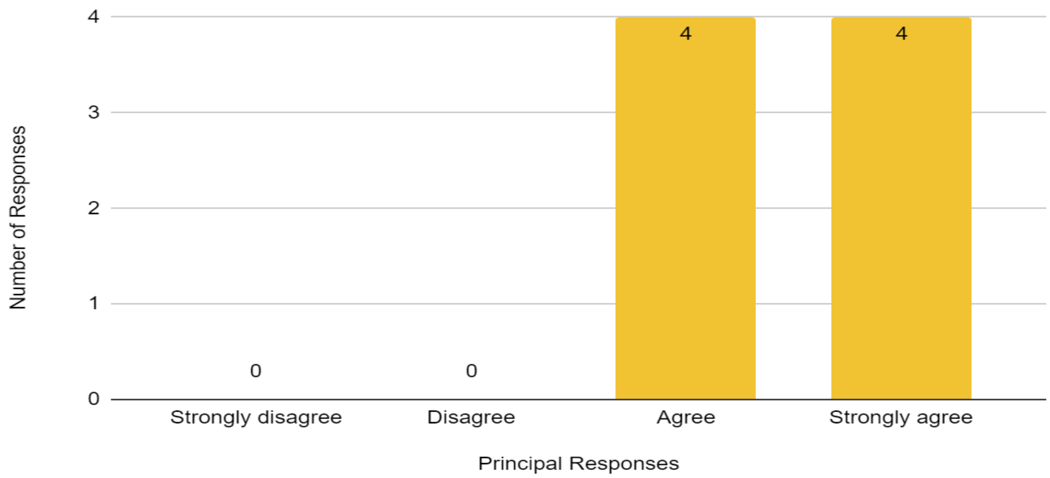


Figure 18 shows the principals' responses to the statement: Science is taught daily at my school. Seven out of eight principals strongly agreed or agreed with the statement. One of the eight principals disagreed.

Figure 19

Survey Statement Sixteen: Science is Taught Daily at My School

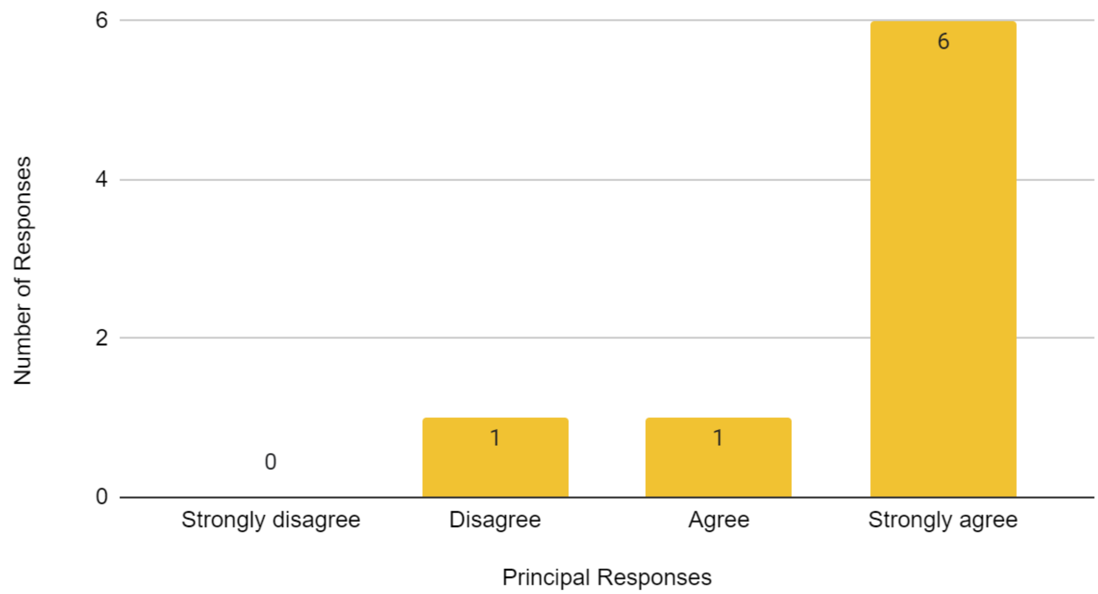


Figure 19 shows the responses to the statement: I budget as much for science as I do for reading and math. Three of the eight principals strongly agreed that they budgeted as much for science as reading and math. Five of the eight principals strongly disagreed or disagreed.

Figure 19

Survey Statement Seventeen: I Budget as Much for Science as I Do for Reading and Math

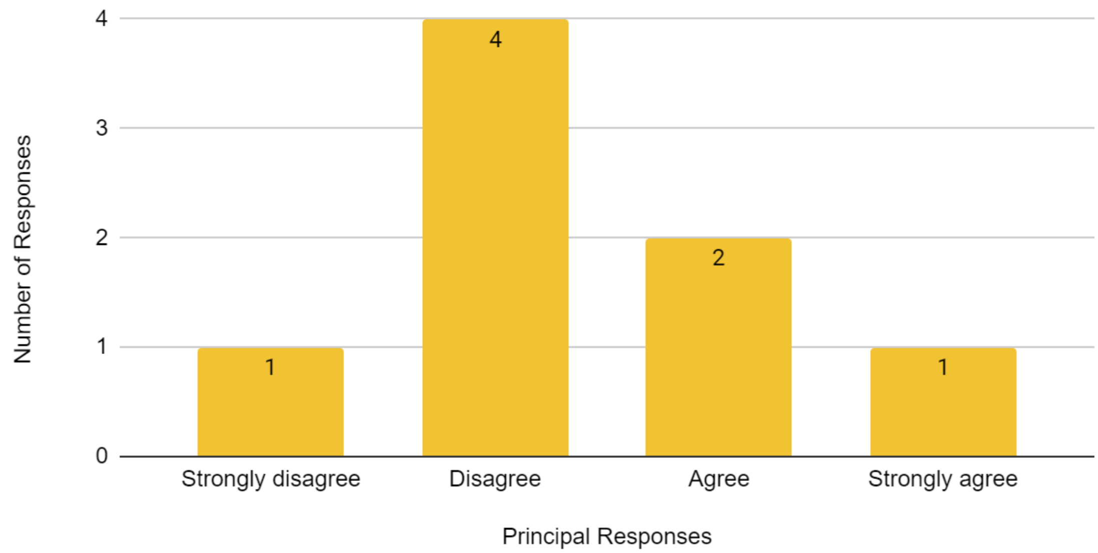


Figure 20 reflects the responses to the statement: I hold professional learning communities centered around science. Four of the eight principals strongly agreed or agreed they held professional earning communities centered around science. Conversely, four of the eight principals strongly disagreed or disagreed they had professional learning communities centered around science.

Figure 20

Survey Statement Eighteen: I Hold Professional Learning Communities Centered Around Science

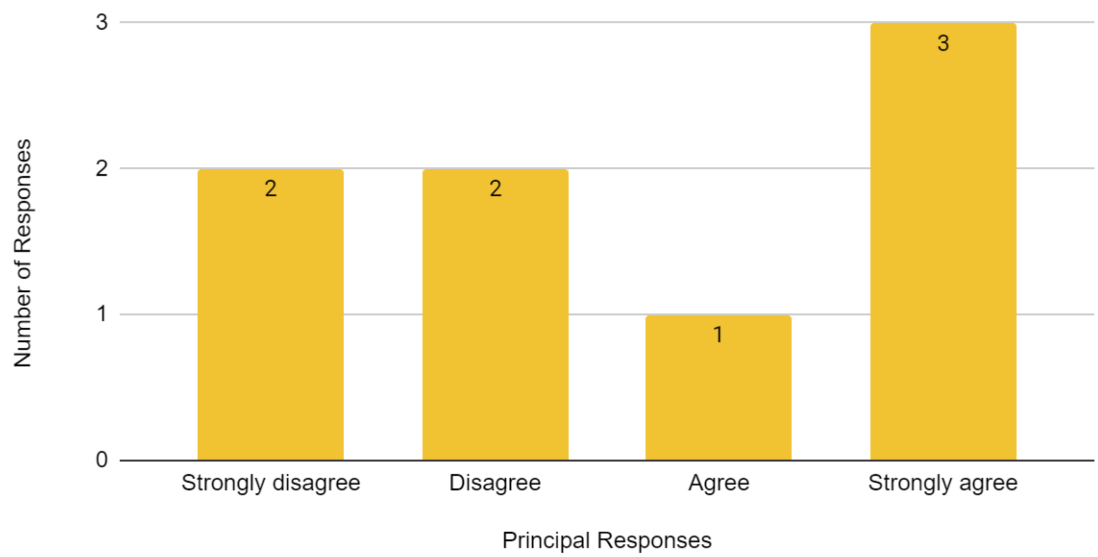


Figure 21 shows the principals' responses to the statement: My school has identified essential standards in science. Five of the eight principals strongly agreed or agreed they had identified necessary standards in science. Three of the eight principals strongly disagreed or disagreed they had identified essential standards in science.

Figure 21

Survey Statement Nineteen: My School has Identified Essential Standards in Science

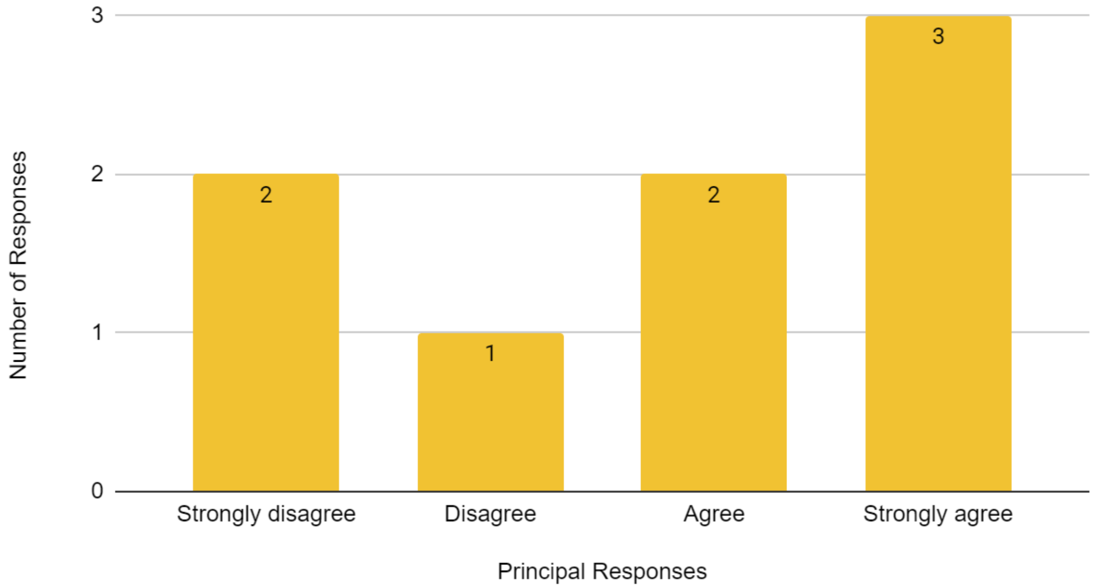


Figure 22 shows the responses to the statement: I feel confident in leading science meetings at my school. Five of the eight principals strongly agreed or agreed they felt confident leading science meetings at the school. Three of the eight disagreed that they felt confident leading science meetings at the school.

Figure 22

Survey Statement Twenty: I Feel Confident in Leading Science Meetings at My School

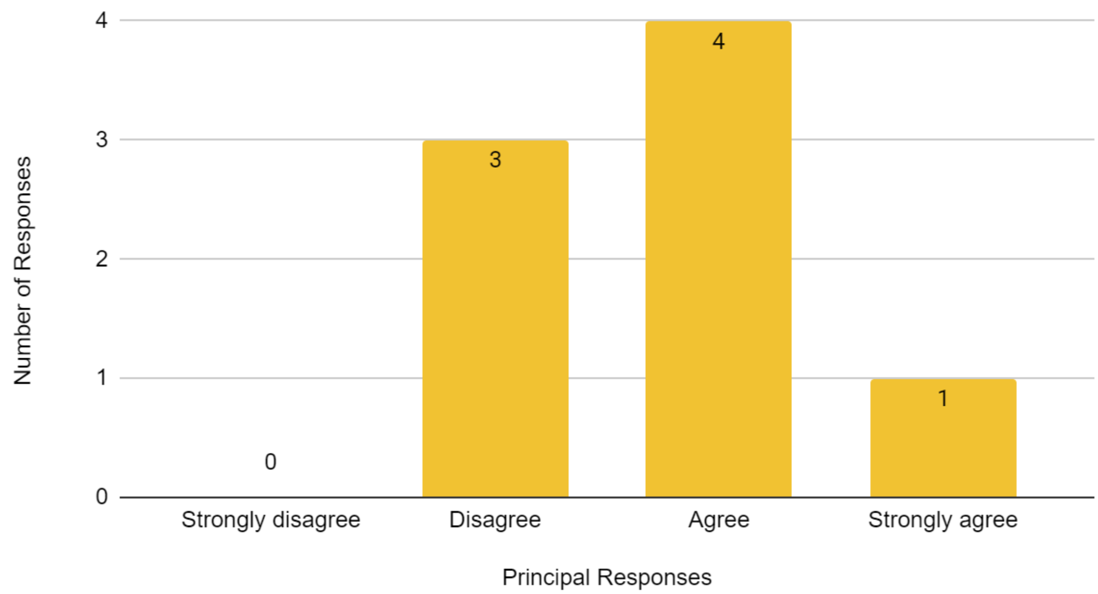


Figure 23 shows the principals' responses to the statement: My school has science scores above the state average. Two of the eight principals strongly agreed the science achievement scores at their school were above the state average for science achievement. Six of the eight principals strongly disagreed or disagreed the science achievement scores at their school were above the state average for science achievement.

Figure 23

Interview Statement: My school has science scores above the state average

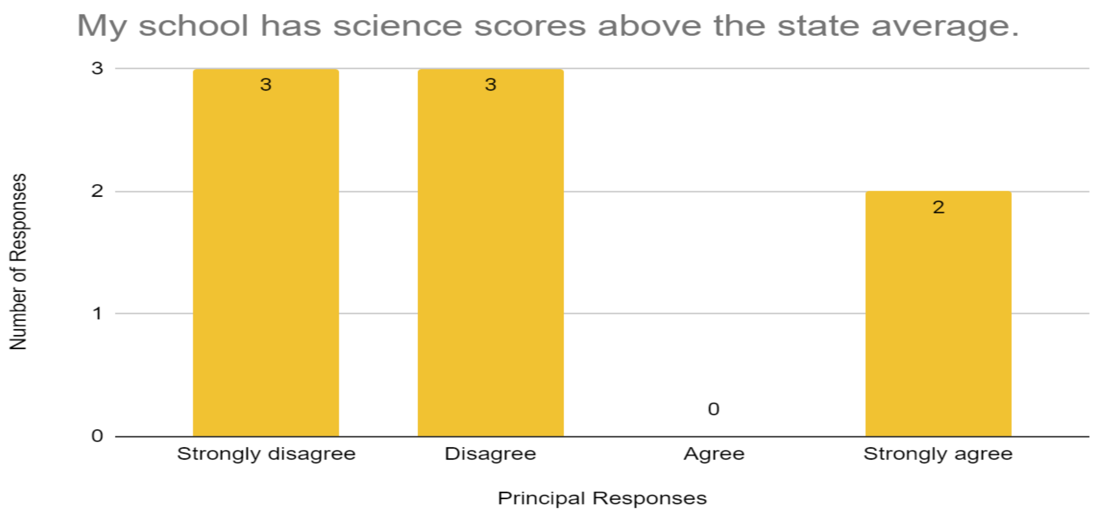


Figure 24 shows the responses to the statement: I have ensured a science goal was included in the school improvement plan. Only one of the eight principals strongly agreed they had included or created a science goal in the school improvement plan. Seven of the eight principals strongly disagreed they had included or created a science goal in the school improvement plan.

Figure 24

Survey Statement Twenty-One: I have ensured a Science Goal is Included in the School Improvement Plan

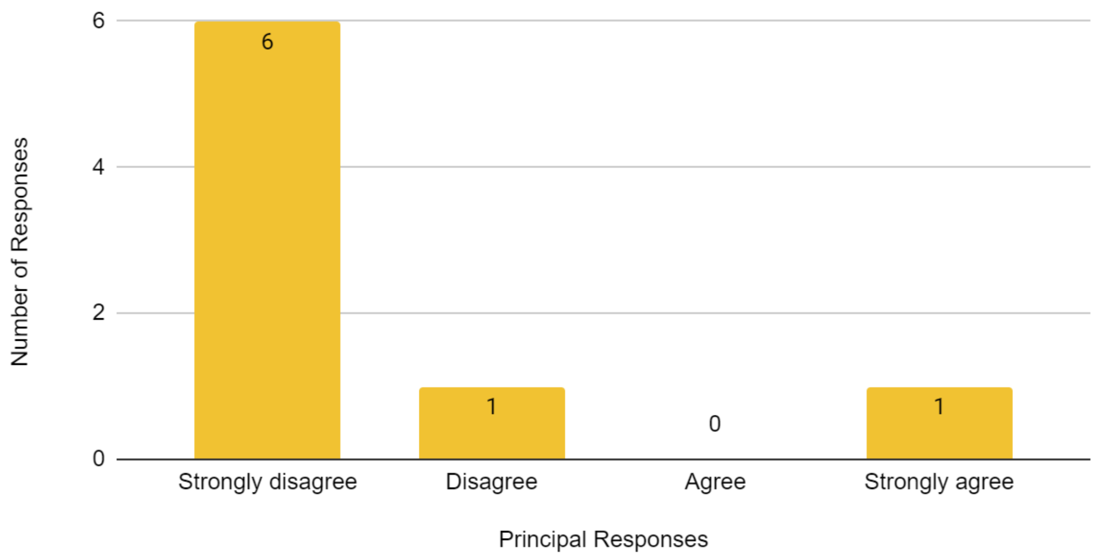


Figure 25 shows the responses to the statement: My district emphasizes science education. Two of the eight principals agreed the district emphasized science. Six of the eight principals strongly disagreed or disagreed the school district emphasized science.

Figure 25

Survey Statement Twenty-Two: My District Emphasizes Science Education

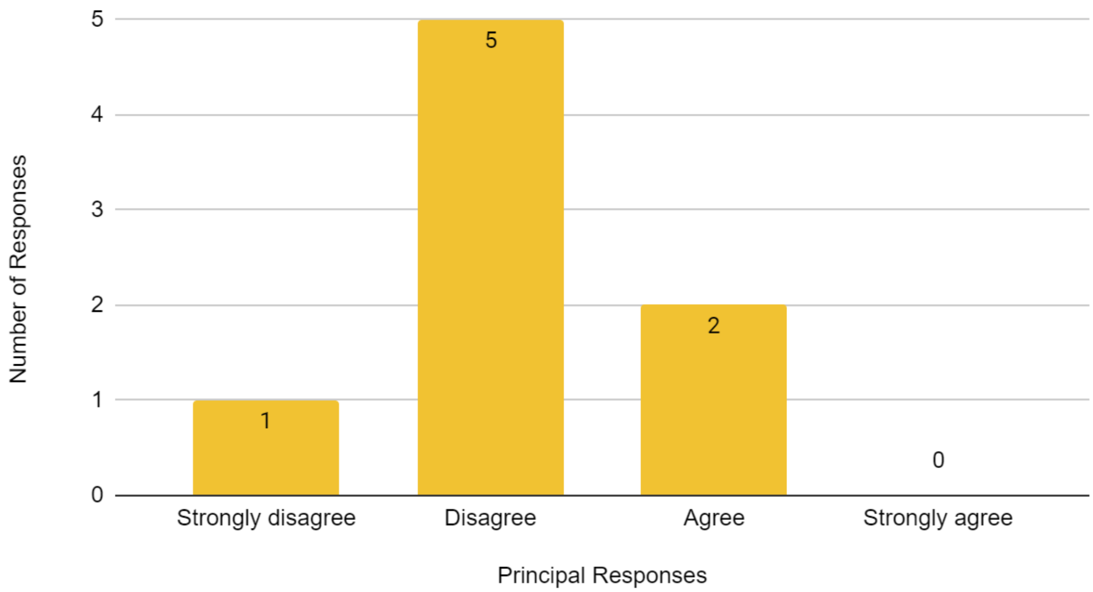


Figure 26 demonstrates the principals' responses to the statement: I feel science should be taught at the elementary level. All eight principals strongly agreed or agreed that science should be taught at the elementary level.

Figure 26

Survey Statement Twenty-Three: I Feel Science Should Be Taught at the Elementary Level

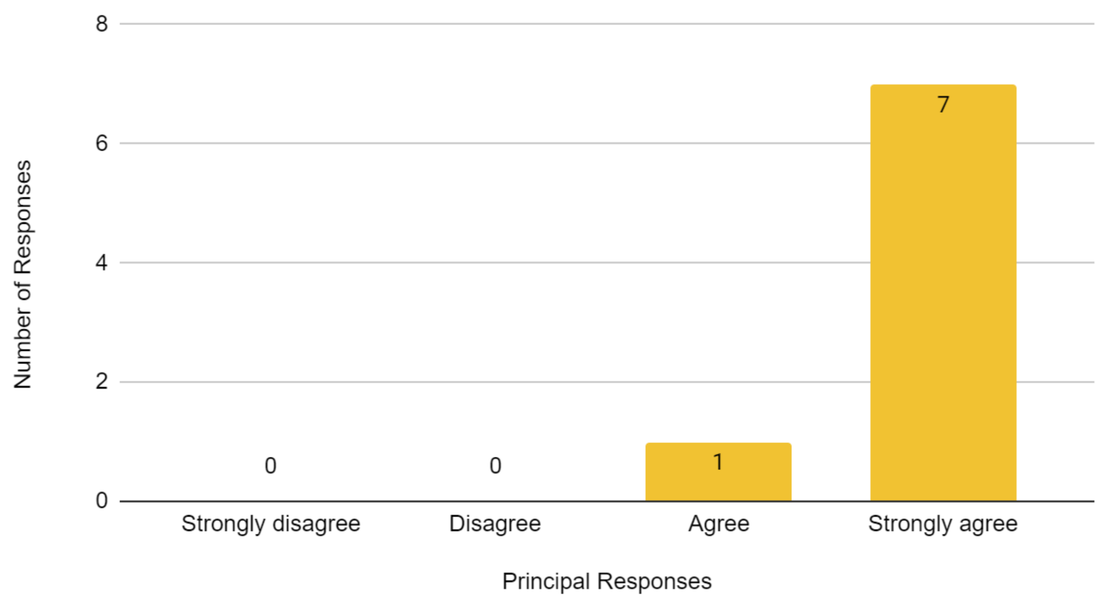
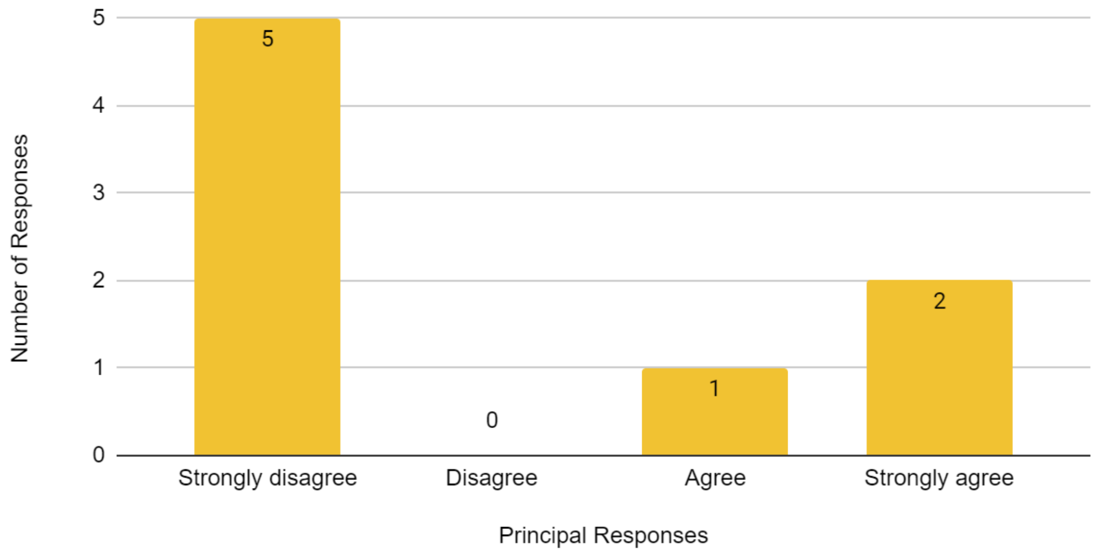


Figure 27 shows the principals' responses to the statement: I feel my educational background provided me with a science background. Three of the eight principals strongly agreed or agreed their educational experience provided them with a science background. Conversely, five of the eight principals strongly disagreed their educational background provided them with a science background.

Figure 27

Survey Statement Twenty-Four: I Feel My Educational Background Provided Me with a Science Background



Principal Interviews

The research question that pertained to the interviews conducted was: Which leadership characteristics have the most significant impact on science achievement: experience, leadership style, science background, philosophy, or education? To investigate the primary question, I analyzed qualitative data in the transcribed responses from the semi-structured interview questions held with the principals. I focused on the ten elementary and middle school principals for this section of the research study. Unfortunately, only nine principals were available to interview as one principal position was vacant all year.

After establishing a date and time for the interviews, I sent a Google Meet link to each principal. I had the transcriptions populated in a Google document upon completing the interviews. First, I compared the notes I took during the semi-structured interviews with the transcriptions to ensure the notes were accurate. Then, I began looking for short phrases and similarities among the responses. The Google Meet transcriptions allowed me to identify patterns emerging within the principal reactions. See Figure 28 for a list of themes I discovered and coded according to the following principal characteristic categories: leadership style, philosophy, experience, and education.

Figure 28

Principal Characteristic Categories: Leadership Characteristics with Specific Examples

Category	Survey Results	Specific Examples and Results
Leadership Style	• Three of the nine principals expressed they were shared leaders. • Two of the nine stated they were servant leaders. • Three of the nine varied from visionary, collaborative, and data-driven.	"Shared Leadership, I know I'm an administrator, but my job is to allow our teachers to do the best job. So, my job is to give them whatever support they need." "My leadership style is shared leadership. I like to find people that have strengths. Especially better ones than I have and try to grow my own and try to give credit where credit is due." "Visionary, sometimes people say I am an instructional leader. I lead more from a team approach."
Leadership in Action	All principals prioritized the subjects by importance in the same order: ELA, Math, Science, and Social Studies	"I love science now that I think about it, but everyone needs to read and be able to do the math." "I don't know why I prioritized in that way. I know the kids enjoy science; I think a little bit more than they do social studies."

Leadership with School Improvement	All principals established an ELA goal on the school improvement plan. • Four of the nine included a math goal on the school improvement plan. • One of nine included a science goal.	"At the time, I was like, we don't need to teach science as it is not my top priority." One principal stated they had ELA and History goals. Then he paused for a minute. "Let me check real quick. We have a Lexile and math goal."
Leadership actions addressing change for science	• Three of nine mentioned wanting more testing in science. • Two of nine mentioned wanting hands-on inquiry-based activities. • Two of nine wanted continuity throughout the district. • One of nine wanted to see the state follow the Next Generation Science Standards. • One of nine was not sure what they would change.	• Three of the nine principals feel their students are receiving adequate instruction in science. • Four of nine principals stated they were unsure if students were not receiving adequate instruction. "In our building, probably. But from our building to the middle school, probably not." • Two of the nine principals stated students were not receiving adequate instruction. • Seven of the nine principals have not spoken with district leaders to identify struggling areas in science. • Six of nine principals stated district leaders have not offered support in critical areas within the science content.
Philosophy on Leadership	• Three of nine identified they need to support teachers. • Three of nine expressed their philosophy was to lead by example. • Three of the nine varied from inspiring, treating others with respect, and decision-maker.	"I just believe that leadership should lead and be able to rally the troops and to keep them focused and send it on the vision and mission, but also realize they can't make the decisions themselves." "I think if you have initiative, if you have drive, if you have passion and you're truly committed, then you are a leader"
Experience	• Five of the nine principals had been in administration for between 1 and 10 years. • Two of the nine principals had been in administration for 10-15 years. • Two of the nine principals had been in administration for 15 to 20 years.	• Three of the nine principals held a principal's position for between one and five years. • Four of the nine principals held the position of principal for between 5 and 10 years. • Two of nine principals held the position of principal for between 5 and 10 years.

Educational Background	• Two of the nine principals had a physical education background. • Two of the nine principals had a middle grades education background. • Two of the nine principals had alternative certificates. • One of nine principals had a music education certificate. • One of nine principals had a special education background. • One of nine principals had an art education background.	None of the sitting principals had elementary education background experience.

I was interested in conducting this research based on the existing science grades in the school system under study. Science achievement at one of the elementary schools was above the state average. During the principals' semi-structured interviews, only two principals stated their students were not receiving adequate instruction in science. The school system's mission was to employ time and strategies so that all students could achieve high levels of understanding. This mission incorporated science instruction and achievement. Subsequently, I utilized the AS-IS diagnostic tool (Wagner et al., 2006) to establish an account of the current reality of the school system under study in the areas of competency, conditions, culture, and context (See appendix A).

Contexts

Wagner et al. (2006) described context as a skill set needed to be successful in school, the community, state, and global platform of the students served in the school and school system (p. 104). In the school system under study, the focus had been on the intermediate grades that tested content subjects. The tested content subject areas in the state under study were English Language Arts, math, and science in fifth grade. Over the past several years, the state weighted the content domains impacting the schools' and school systems' accountability ratings. English Language Arts and math were weighted more than science. Therefore, school system administrators overlooked science. Science had not received equal time in the academic day nor funding resources from the school system. Thus, student achievement in science had remained below the state average.

My research centered around the school principals' impact on science achievement. The school principals must have a solid understanding of the skillsets needed for students to elicit change successfully. During the 2020-2021 school year, the school system did not provide science training for principals. According to the principal surveys, only one of the eight principals attended science training during the 2021 school year. I wanted to decipher from the research which characteristics of principals impacted student achievement in science. The data from the study showed principals' leadership characteristics did not support science as much as the other content areas. The principals' actions regularly overlooked science in budgeting, school improvement goals, and the importance of science compared to other subjects.

The research from the principals' surveys and semi-structured interviews showed that principals did not feel as if the school system emphasized or supported science. The school system needed to establish a commitment to systemwide achievement for students in all content subjects and the expectations of the educators in the system (DuFour et al., 2016, p. 239). Principals' actions mirrored the priorities established by the school system.

Culture

Culture is the way things are done (Reeves, 2009, p. 37). During the last accrediting visit, the accreditation organization mentioned the school system was a system of schools versus a school system [citation withheld to protect the system under study]. The building principals operated as separate entities. The school system had a high turnover rate with building principals. In the year of this study, three of the ten building principals left the school system. In the decade before my study, every school had at least two different principals, and three of the schools had four or more different principals.

Elementary school principals focused on English Language Arts and math, while they placed less emphasis on science. According to scheduled instructional time, professional learning on instructional practices, and designated funds for updated science resources, principals perceived science as a lesser content area. According to the teacher survey, over half of the teachers who responded agreed the building principal did not emphasize science at their school. In addition, the school system leaders had not guided building administrators on improving student achievement in science. The school year before my study was the first year the system had a science pacing guide the principals and teachers could use to guide their instruction.

In 2018-2019, all elementary schools' science achievement in the system under study were below the state average on the state assessment. Yet only one school had a school improvement goal addressing science achievement. One of the ten elementary schools fell in the bottom 10% of the state's schools, placing them on a failing list partially due to the low science achievement of the school. During the 2019-2020 school year, this school did not plan to address science achievement. According to my research, over half of the teachers surveyed stated the principals had established a science goal in the school improvement plan. The response directly conflicted with the principals' responses regarding science goals. Only one principal agreed they had a science goal for the school. The survey results reflected a conflict with the current reality and expectations in the schools. Teachers were unaware of what goals were actually on the school improvement plan as over half of them stated their school had a science goal. The school placed on the failing list was partially due to science achievement, yet the principal did not create a goal to improve science achievement.

According to DuFour et al., principals need training in order to lead (2016, p. 248). The school system had not provided training for school administrators in science in the previous ten years. According to Reeves, “The single greatest impediment to meaningful cultural change is the gap between what building leaders say they value and what building leaders actually value” (2009, p 37). According to the surveys, seven principals had not attended any science training during the 2021 school year. However, over half of the teachers reported the building principals provided training for them. Half of the building principals reported holding professional learning communities addressing science. My research showed that over half of the science teachers participated in a professional learning community addressing science in their buildings.

Conditions

Unlike culture, which is the invisible working of the school, conditions are the tangible elements in the school system organization: time, space, and resources (Wagner et al., 2006, p 101). One of my main research questions was: What impact do school principals have on science achievement? It was best to look at how the principals handled the conditions regarding science achievement. The school system under study had placed rigid time elements for reading, math, and intervention over the past five years, totaling a time commitment of four and one-half hours daily. After the activity rotation and lunch, the teachers were left with an hour to teach science, social studies, and writing. The principals adhered closely to the rigid time structure. During the semi-structured principal interviews, one principal mentioned time as a barrier to teaching science.

The school system under study followed the state curriculum guide and teaching units for science. The system did not have a county-wide pacing guide with system resources mentioned. The school system's science resources were located in various places, making it difficult for principals to find science resources.

In 2016, the state for the school system under study adopted new science standards; however, leaders did not purchase updated resources for the elementary schools. Some building principals started buying online science resources for their teachers. Many teachers at the schools were using an online curriculum, *Mystery Science*. Even though *Mystery Science* directly aligned to the Next Generation Science Standards (NGSS), it did not correlate with the state-adopted science standards for the school system under study. For example, the school system under study's fifth-grade science standards aligned with the fourth-grade NGSS. The alignment of Mystery Science created many classroom teachers teaching the wrong criteria for their grade level if the teachers did not participate in training and professional learning communities addressing science standards and the purchased resources.

The school system's curriculum office personnel delivered professional learning and training directly to the teachers. Building level principals were never the intended target of professional learning. Building level principals attended a monthly informational session to gather operational and managerial information to complete in their school setting. My experience as a former principal was that system leaders never discussed science, nor was it a topic of discussion at principal meetings. The principal survey showed only two of the eight principals responded that the system emphasized science. During the semi-structured interviews with principals, six of the eight principals stated the school system did not assist them with identifying critical weaknesses or aid in supporting science content.

My data from the principals' surveys showed that six principals did not budget as much funding for science as they did for other content-related areas. The teachers' survey showed that 18 of 39 teachers responded they did not have lab equipment or materials to conduct science experiments. Since the adoption of the new science standards in 2016, it has been difficult for teachers to ensure students could obtain, evaluate, and communicate the science standards proficiently without lab equipment and materials needed to conduct experiments. In addition, the school system did not have a district science goal, making it difficult for principals to use federal monies to support science instruction. As one school had a school improvement goal written for increasing science achievement, the principal was able to use federal funds to support science instruction in their building. However, the equity of science funding compared to the other content areas throughout the system was lacking.

Competencies

According to Drago-Severson et al., the learning and growth of the adults in the system have a positive and direct influence on student achievement (2013, p. 4). As my research question was searching for the impact the principal had on science achievement, I inquired about the training and background of the principals. Since the school system prioritized English Language Arts and math, professional learning targeted those two content subjects. The school system designed professional learning to target only lead teachers and teachers new to grade level. Therefore, principals had not been the target of professional learning for the previous ten years and had not been the instructional leaders delivering professional learning. Instead, they contacted the school system's curriculum department personnel to support the teachers. Drago-Severson et al. mentioned that building principals should support teachers in learning and teaching, while the district office staff should target principals and assistant principals to support adult development and student achievement (2013, p. 6). Since the adoption of the new state science standards in 2016, the school system leaders have not provided professional learning for principals or teachers to learn about the new science standards.

Interpretation

As I embarked on this study, I did not foresee how the administrative turnover at the system under study could impact my research. The system under study had a 30% turnover with elementary principals. When I started my research, all elementary schools had principals. Then during the 2020-2021 school year, system leaders removed one elementary principal, placed an acting principal in the position for the remainder of the year, and non-renewed one principal's contract in March 2021. Additionally, one principal retired in December of 2020. The one non-renewed principal continued to participate in the research. Therefore, the timing of the data collection impacted the principals' responses. The system underwent a superintendent search during the school year of 2020-2021. Many initiatives and instructional decisions were placed on hold until the new superintendent took office in May 2021.

In this study, I identified the conditions creating a high percentage of students lacking proficiency on the end-of-year science assessment and how the school principal's leadership characteristics impacted achievement. Therefore, I used a mixed-method approach to triangulate data from extant science achievement scores from the state website, teacher and principal Likert Scale surveys, and principal semi-structured interviews. I collected extant science achievement data for the school year 2019 and school year 2021. Due to the COVID-19 pandemic, the state suspended testing for the school year 2020. The principal's leadership characteristics had a direct impact on student achievement. Every principal in my study prioritized science under English language arts and mathematics. According to the end-of-year assessments, the student achievement data results reflected student proficiency in the same order.

An analysis of the extant data collected revealed that five of the ten elementary schools showed positive gains on the end-of-the-year science assessment in 2021 compared to the 2019 science assessment. There were a couple of factors to support why some schools showed an increase in science proficiency. The school system leaders created a science pacing guide with resources provided for teachers. The Science Director sent reminders to the building principals of what teachers needed to focus on each semester. Then six weeks before testing, the science director recommended the teachers revisit Life Science and Physical Science taught earlier in the year. The science pacing guide had resources and activities teachers could utilize. Due to one of the principals being out on leave, the science director served as director and acting principal in a dual capacity. Therefore, the science director had limited ability to implement or procure updated materials for the schools in the school system. The school system under study went from one elementary school scoring above the state average to three schools scoring above the state average. However, the average for the school system under study remained behind the state average in students scoring proficient on the end-of-year science assessment. However, the extant data needs to be considered cautiously due to inconsistent virtual learning and brick-and-mortar instruction throughout the pandemic year. The state reported a decrease in the number of students taking the end-of-year assessments in 2021. System leaders attributed the drop to students opting out and parents not sending their children into the school building to take the state assessment.

The quantitative data collected from science teachers' survey results indicated science teachers perceived the building principal considered science as important as reading and math and stated the school had science goals. The science teacher survey results proved contradictory to the principals’ survey results regarding the emphasis on science instruction. The science teacher survey responses to item number 5 (Figure 7): My school principal considers science as necessary as reading and math, indicated that 61% of the science teachers perceived the building principal considered science as equally important as reading and math. However, 56% of teachers responded they did not have updated science teaching materials (Figure 8). I asked in item number 10 on the science teachers’ survey for teachers to respond to: My principal emphasizes science education. Responses indicated 43% of the science teachers perceived the building principal emphasized science instruction (Figure 12). Subsequently, science teachers did not perceive the building principals provided training, adequate funding for resources and science materials, and feedback or suggestions directly related to science instruction—the characteristics presented from the results now aligned with the leadership actions and philosophy of the building principal.

The data gathered from the building principals reflected similar results as what science teachers perceived in the area of funding provided for the content area of science, with 62% stating they strongly disagreed or disagreed with budgeting as much for science as other content areas (Figure 19). Five of the eight principals said they did not meet the budget as much for science as English language arts and mathematics. According to the results, 100% of the principals agreed or strongly agreed science was essential. (Figure 17). However, only 12% of the schools had a science goal in the school improvement plan (Figure 24). The results differed drastically from the teacher's perception of science instruction, where 43% strongly agreed that the building principal emphasized science instruction (Figure 12). The results indicated that 37% of the principals did not feel confident in leading science meetings (Figure 22). Principals must be confident in supporting the teachers to elicit change in the building. The school system's state has science as part of the accountability equation. Therefore, principals focused on the state's accountability formula. The weight on the school system accountability report for science was less than English language arts and mathematics. The principals' survey results showed only 12% of the principals attended science training in the previous year (Figure 16), and only 37% of the building principals had a science background (Figure 27). This aligned with the survey results where 46% of the science teachers strongly agreed or agreed principals provided suggestions and feedback directly related to science instruction (Figure 14).

The qualitative data collected from the nine building principals' semi-structured interviews were designed to find answers to research question 2: Which leadership characteristics have the greatest impact on science achievement: experience, leadership style, science background, philosophy, or education? The results from the interviews depicted none of the elementary school principals graduated from college with an elementary education degree. The education degrees of the building principals ranged from physical education, special education, art backgrounds, and middle grades degrees to a non-traditional path into teaching. Smith and Smith mentioned that leaders need to be directly involved in providing feedback to teachers and leading and participating in professional learning (2015, p 10). Without an educational background and robust professional development, it is challenging to be an instructional leader. The principals' educational background explained why 54% of the teachers disagreed with their principals providing feedback and suggestions (Figure 14). The interviews showed that many principals considered themselves shared leaders or servant leaders. The principals used the term shared leader and servant leader synonymously throughout the process. Three of the eight principals mentioned their philosophy was to lead by example. Principal 4 stated, "Don't ask someone to do something that you wouldn't do." As science achievement plagued the schools, the principals' misunderstanding of shared leadership resulted in a lack of instructional leadership. All principals expressed that the teachers were the ones who knew what was needed, and the principal's job was to provide what they needed to teach in their classrooms.

There are several elements to consider when interpreting the results of the study. The results indicated a discrepancy between the principals' perception of what happened on the school campus and what science teachers perceived to be communicated and emphasized by the building principal. Principals (65%) felt competent in leading science meetings (Figure 22), yet 54% of the teachers stated the principals did not provide feedback or suggestions about teaching science(Figure 14). The data from the interviews and surveys demonstrated consistency in the misalliance of what building principals thought was being communicated and what was occurring.

The results of my study showed that 75% of principals indicated that the system-level leaders did not emphasize science (Figure 25). Therefore, the principals followed suit with the amount of emphasis they placed on science. The school system needed to set the expectation for science academics. The principals would follow the lead set by the school system.

There was a lack of clear communication between the building principals and the science teachers. Science teachers stated science goals were in the school improvement plan, yet only one school had them. Overwhelmingly the data showed principals did not provide updated materials, resources, or training for their teachers in science, even though 62% of the teachers responded the principal considered science equally important as reading and math (Figure 7). The actions of the principals showed differently.

Judgments

The essential question that guided my research was: What conditions create the high percentage of students lacking proficiency on the state science assessment? The extant data I collected revealed that students in the school system under study showed marginal gains on the end-of-year state assessment. I was unable to compare the data to the state data as the state did not release an accountability report in 2020 due to COVID-19. The data collected indicated a lack of updated science resources, a lack of principal focus on science, and a lack of professional learning for teachers and principals.

My primary research questions were:

- What impact does the school principal have on science achievement?
- Which leadership characteristics have the most significant impact on science achievement: experience, leadership style, science background, philosophy, or education have the most significant effect on science achievement in Grades 2-6?

The data analyzed throughout the study have shown that teachers' perception data did not align with the principal's perception data in two areas: emphasis on science instruction and the principals' feedback and suggestions related to science. The results showed teachers understood the priority of the principals with the lack of emphasis placed on science compared to English language arts and mathematics. Therefore, teachers followed what the principals emphasized as important. Thus, the leadership style and philosophy of the principal were essential.

These results showed a lack of clarity in the principal's vision for the school. Smith and Smith noted that establishing shared goals and clearly articulating the goals is one of the five elements of enhanced leadership practices (2015, p. 10). The principal's semi-structured interview data indicated that the building principals focused on supporting the teachers. Principal 4 stated they have a loose management style with teachers. The loose management style was the theme throughout the principals' data.

Principals misconstrued the meaning of shared leadership. The principals explained shared leadership as supporting teachers. None of the principals mentioned building leadership capacity by coaching, measuring performance, and gathering input from the science teachers. Principals did not clearly articulate a focus and vision for science; as principals stated their responsibility was to support the teachers with their requests to allow them to teach. Leadership was lacking from the building principal, creating conflicting messages and visions at the school level.

Solid leadership in the buildings by the school principals would make a difference in science achievement. The schools making gains had leaders who embraced the professional learning community process. They understood the importance of utilizing data and setting expectations in the building.

Recommendations

The superintendent and assistant superintendent of curriculum and instruction can improve science achievement data by focusing on building the leadership capacity of the school principals. According to Smith and Smith, the impact of the leadership from principal practices is the most critical factor in driving school improvement (2015, p. 1). Despite the effect of COVID-19 on instruction, the school system under study did show slight gains on the end-of-year science assessments in 2021. The scores were closer to the state average as they went from 18% below the state average, with students proficient in the evaluation to 9% below the state average. Therefore, I recommend leaders of the school system under study require principals to attend monthly meetings focused on creating clear student achievement goals, aligning funding resources to the school improvement goals, and evaluating and analyzing the data gathered to ensure the forward trajectory of student achievement in science.

The end-of-year science assessment data showing small gains in science achievement supports the need for ongoing and intense professional development for the principals. Targeted continuous monthly professional learning will dramatically impact student achievement. Therefore, I recommend the school system reverse the organizational, professional learning focus for science from teachers only to include the principals. An increased interest in developing principal talent will support the necessary change to embrace collaboration and professional culture within the school system (Odden, 2012).

Principals need to work closely with system leaders to focus on best practices aligning with the school system's improvement plans. I recommend principals engage in professional learning around high-impact strategies to support teacher and student learning. Principals need guidance on how to embed adequate instructional time in the daily schedule and adequate funding earmarked for current science resources addressing the state under the study's science standards.

Conclusion

The mixed-method approach of my study allowed me to conduct a thorough analysis of leadership characteristics of principals and how the characteristics impact science achievement. My findings suggested the school system under study has an opportunity to make a profound impact on student achievement by providing a robust professional learning plan for school principals. Professional learning for the school system needs to focus on continuous improvement of teaching, learning, and instructional leadership (Wagner et al., 2006, p. 34).

Chapter Five: To-Be Framework

My mixed-method evaluation aimed to evaluate and discover obstacles and barriers negating science achievement. Specifically, I sought to analyze the leadership characteristics of principals and how the characteristics influenced science achievement. During 2018-2019, nine out of 10 elementary schools in the school system under study were scoring well below the state average in science. Additionally, the State Department of Education placed one elementary school on the state's failing school list based on the science achievement scores. The state-assigned school improvement specialist indicated several elementary schools were in jeopardy of landing on the failing school list due to the lack of student achievement in science. Then due to the national pandemic, the state of the school system under study did not participate in state-mandated assessments for the school year 2019-2020. Although the school system under study did participate in mandated testing again in the school year 2020-2021, the number of students who participated in the testing was slightly down due to the pandemic. There was principal turnover at three elementary schools: one principal retired in December 2020, the school system reassigned one principal to another position in August 2020, and one principal did not receive a contract in March 2021.

I discovered a disconnect between the data gathered from science teachers' and principals' surveys. The survey results showed distinct differences in perception in the following areas: emphasis on science instruction at the school building, the principal's feedback and suggestions related to science, and science goals created for the school. Principals stated the system leaders did not emphasize science. During the semi-structured interviews, all principals said science was as important as other content areas but ranked it under English language arts and math. During the interviews, principals reported they did not adequately budget for updated science resources. I will develop a change leadership plan for the school system under study to address the low science achievement on the end-of-year science assessments. The change leadership plan will provide a clear, concise, and intentional focus on science goals for the design and schools, science training for teachers and principals, a district science pacing guide with current science resources, a science instructional model, and daily science time.

Envisioning the Success To-Be

The change leadership plan for the school system under study envisions many students scoring proficient on end-of-year science assessments and principals enhancing science achievement. I use the Wagner et al. conceptualization (2006) TO-BE Analysis Diagram to indicate the potential future in context, conditions, culture, and competencies (See Appendix E). System leaders will present principals with clear and concise guidance to provide feedback and suggestions to enhance the science teachers' daily instruction. Principals will have the wherewithal to support pedagogy and strong content knowledge in science. Science teachers will have a daily dedicated instructional block to teach science. According to the National Science Teachers Association (NSTA), science should have equal learning opportunities as the other content areas and strive for 60 minutes of science instruction daily (NSTA, 2019). Teachers will have adequate resources to teach science.

All principals will engage in the Professional Learning Community (PLC) model to focus on student learning, student achievement data, and teacher collaboration to provide a positive outcome for science achievement (Burns et al., 2018; ndunda et al., 2017). Principals will serve as leaders and learners of professional development to support collaboration and reinforce the focus of a school-wide goal of learning for all students in science (Smith & Smith, 2015). When principals are the lead learners and leaders of professional learning, teachers will see science instruction as essential.

Future Context

Settlage et al. argued principals who allocate time devoted to developing the educational needs of the teachers, whether it is pedagogy or content, educational programs and conducting observations will result in significant improvement in student achievement (2015). Therefore, the school system under study will make drastic changes to improve student achievement in science, as described in my TO-BE Analysis Diagram (see Appendix E). Teachers are reluctant to participate in new instructional practices unless principals support them (Keller & Pearson, 2012). Conventionally, principals focus professional development on the heavily weighted assessment content areas such as English language arts and math, perpetuating inequities among students exposed to high-quality science instruction (Hayes & Trexler, 2016, Miller et al. 2015, Parker et al., 2015). Principals focus on the heavily weighted assessment content areas due to how the accountability system rates the school in the state under study. In addition, school system leaders derive 40% of the principals' evaluations from student achievement on the end-of-year assessments. The most potent leadership practice for impacting student achievement occurs when principals lead and participate in teacher/leader learning and development (Smith & Smith, 2015.)

Generally, elementary teachers are not well prepared to teach science due to their lack of science content background, resulting in over-reliance on a didactic pedagogy

(Kleickmann et al., 2016, Hayes & Trexler, 2016). Therefore, professional development needs to begin with what teachers know and build upon it (Smith & Nadelson, 2017). Professional development will no longer be a one-day sit-and-get workshop in the school system under study. Instead, it will be a two-prong approach that institutes training and job-embedded coaching throughout the year, as professional development alone is not enough (Dailey, 2016, Guzey et al., 2016). Teachers will have the opportunity to participate in initial training. Then throughout the year, teachers will have access to coaches to support them with implementing the training in which they participated.

System leaders are the lynchpin to set expectations for adult professional learning within the school system. Therefore, the system leaders will create situations to support principals in adult development that directly impacts student achievement (Drago-Severson et al., 2013). System leaders will provide the principals and schools with a continuous and common message to focus on clear priorities within certain boundaries that correlate with the science instructional framework. Principals will utilize the school system's approved resources, pacing guide, and instructional framework to ensure daily science instruction.

Future Culture

The rural school system under study will change from an underperforming school system in science achievement to one competitive with the state achievement average. Principals will feel confident in leading and providing feedback to science teachers. System leaders will prioritize science by creating system science improvement goals. The message from system leaders will demonstrate the importance of school leaders needing to generate a science goal. In addition, system leaders and principals will require professional learning communities centered around science at both the school and system levels.

For the school system to make sustainable and real change, system leaders, in conjunction with principals, must be able to face the uncomfortableness of change as they address the urgency of student achievement in science. Engagement in meaningful discussions is pivotal to learning together. Engagement does not equate to an agreement but implies a culture of respect to work together to address problems plaguing the school system (Wagner et al., 2006). Leaders will be confident in leading professional development and building leadership capacity in the school buildings. Engaging and leading professional development does not equate to the solo expert in the building. The principal will build leadership capacity within the school, so science teachers share and collaborate during the learning process.

As today's job market relies heavily on the Science, Technology, Engineering, and Mathematics (STEM) careers, schools must grow the natural curiosity students enter school with until they graduate (Blank, 2013). Principals must embrace the importance of science education (Parker et al., 2015). Principals will attend professional learning with staff as well as with system leaders in the area of science. The professional learning opportunities will afford the principals further understanding of science standards, concepts, resources, and expectations.

Principals will lead and engage science teachers in science-focused professional learning communities. According to Miller et al. (2015), professional development focuses on teachers' belief systems, content knowledge, and school practice of content. When principals train with the teachers, it provides them with first-hand knowledge of the subject to help them support a teacher whose belief system does not see the importance of changing. The professional learning communities' meetings will begin with reviewing student achievement data to determine what skills students are not able to become proficient at in science including student ability to transition basic knowledge of science into more complex science content knowledge to ensure high academic standards, and student readiness to advance to higher level science study (U.S. Department of Education, 2020). For the science professional learning community to thrive, the principals will ensure weekly dedicated science time focused on the state-adopted standards, how students perform on those standards, and how teachers respond to the data. The culture of the building will change as this becomes pervasive throughout the school system.

Future Conditions

The buildings' concrete structures include instructional time devoted to science daily, updated science resources, and funding to purchase resources (Wagner et al., 2006). Historically, a disproportionate amount of instructional time dedicated to English language arts and mathematics (Jones et al., 2018). In my future conditions, principals will ensure science has a daily dedicated time in the master's schedule. In addition, the master schedule will provide adequate planning weekly for teachers to collaborate and address best practices in science instruction.

Building principals receive an instructional budget every school year. The business department and curriculum office will work closely with the principals to support the principals with an understanding of how to maximize the budget based on student achievement levels. The benefit of the targeted support will allow principals to see how to target instructional monies on updated science resources for classroom instruction. Lab resources are fiscally substantial due to the number of consumable resources purchased yearly. Leaders in the school system under study will budget for updated science resources for kindergarten through eighth grade. The school system's responsibility is to provide a general curriculum for schools and science teachers. The combination of the school allocated budget and school system adopted and purchased resources will optimize instruction.

Leaders in the school system under study will create a policy to address how schools will create and maintain a focus on science achievement. The policy will address science teachers' need for adequate time to problem-solve around learning and challenges of science standards. In addition, the school system will provide a science instructional framework to be established in all science classrooms to allow teachers to unleash their creativity and provide practical components in which to operate. Then in conjunction with science teachers, the school system will create a systemwide pacing guide to address when to teach the science standards.

System-level administrators will support principals and science teachers in using the state’s science instructional framework, systemwide pacing, science resources, and how best practices all are part of maintaining and creating an upward trajectory for science achievement. The science instructional framework consists of an opening, a work session, and a closing. The state provides examples of what each of the three specific areas looks like for teachers and students. This framework provides a gradual release as the lesson practice transitions through the I Do, We Do, You Do concept. During the opening, the teacher will engage the students in a science phenomenon through direct instruction or engage students in investigations. The lesson will transition to the work time, where the teacher will facilitate small groups, facilitating progressive struggles by leading error analysis. During the closing, the teacher will formally or informally assess students' learning independently. This will allow the teacher to adjust to the next day's instruction.

Future Competencies

Elementary and middle school science teachers collaborating on practices as professional learning communities will result in a positive outcome (ndunda et al., 2017). The professional learning community will have a direct impact on increased student achievement when embedded in daily teaching and learning practices by focusing on the following critical components: student data, what students need to learn (standards), content knowledge, and collaboration on high impact strategies (Burns et al., 2018, ndunda et al., 2017, Green & Kent 2016). Science teachers in the school system under study planned for science, but collaborative professional learning models were not used. Engaging in collegial conversations will support the science teachers in collaborating on systematic delivery of science to offset the typical disconnected teaching of concepts and didactic pedagogy (Hayes & Trexler, 2016). As elementary science teachers are typically generalists based on their undergraduate studies, this is imperative for the school system moving forward (Kleickmann et al., 2016).

Jones et al. (2018) noted some researchers blamed school leaders for not providing explicit expectations for teachers on the science curriculum and its implementation. When leaders of the school system under study adopt a science instructional framework, it will give principals a science instructional framework and explicit expectations on how the science classroom should function. The instructional framework will provide principals with direction on what science instruction looks like for teachers and students. Principals will have confidence in what to look for during classroom walkthroughs and how to communicate effectively with science teachers due to their training on the instructional framework. System leaders will provide principals with professional development targeting the instructional framework and encourage using science to support cross-disciplinary collaboration at the school level (Keller & Pearson, 2012). Teachers will understand how science can assist in the different content areas of English language arts and mathematics. Science content can allow teachers to engage students with informational text. Teachers can bring in reading strategies, vocabulary development, and provide evidence from the text to foster cross-curricular connections in the science classroom. The same applies to mathematics, as mathematic concepts are integral to the science classroom. As building principals lead and engage in professional learning communities, they will provide teachers with suggestions and guidance on effective teaching and learning practices (Rieser et al., 2016). As principals partake in communication with science teachers, it will improve the teacher's perception of the principals being able to provide them with effective feedback in science.

Conclusion

I discovered several obstacles leading to the high percentage of students lacking proficiency on the end-of-year science assessments. Therefore, my change plan focuses on the building principal's leadership characteristics. My plan will address three areas of change: system leaders supporting all building level principals, principals supporting teachers with teaching and learning, and a combined effort of the school system and the building principal supporting adult learning and student achievement.

Chapter Six: Strategies and Actions

In considering the strategies and actions in my change plan to address the desired context, culture, conditions, and competencies, I realize a plan of action to address the current situation of student achievement as described in my “As-Is” diagram (see Appendix D) to evolve into my “To-Be” diagram (see Appendix E). The change plan I have chosen to use is a conglomeration of research addressing change leadership and professional learning, as displayed in the Strategies and Actions Chart (see Appendix F). Therefore, the change plan will begin with school system leaders and principals analyzing the current end-of-year science assessment results and establishing goals to address the desired outcomes (Odden, 2012). For the change plan to conceptualize my ideas in the “To-Be” diagram (see Appendix E), the school system leaders will establish specific priorities and parameters at each school and then provide the building principal with autonomy to attack the priorities. If system leaders and principals adhere to the change plan outlined in my Strategies and Actions Chart (see Appendix F), the students in the school system under study will benefit from the information attained from the research study by showing increased student achievement.

Strategies and Actions

The strategies and action plan I propose is an agglomerate of Odden (2012), DuFour et al. (2016), and Kotter (2012). Odden provides a blueprint to improve student achievement in underperforming schools by analyzing the current performance situation, setting goals, and changing the curriculum. DuFour et al. declared people must move from talking about what needs to happen to doing differently for results to happen. In addition, Kotter’s step six of the eight-stage process speaks to the importance of creating and celebrating small wins throughout the change process. The following actions are needed to see results: establish clear priorities and conditions, build the leadership capacity of the principals to be confident and booming in what they lead, establish indicators of progress to monitor, align leadership behaviors with articulated purpose and priorities, and celebrate small wins (DuFour et al., 2016; Kotter 2012). I recommend the school system under study use the change plan to move the trajectory of student achievement in science.

Analyze Current Student Academic Performance

The first step of my change leadership plan is to have the system leaders analyze the end-of-grade science assessment data. School system leaders and principals will investigate and understand all elements of the end-of-grade science assessment. Odden suggested analyzing student performance for patterns (2016, p. 6). Analyzing student performance patterns will involve school system leaders and principals dissecting several years of data by student subgroups, tested standards domains, tested standard elements, and subgroups scoring in the various proficiency levels on the end of grade science assessment. After principals participate in a school system analysis process, school system leaders will host school system data digs. Each principal will bring in their assistant principals and team leaders to undergo the same steps with their school data. School system leaders will be in the room working alongside the teams to facilitate the data discovery and engage in collegial conversations around the findings. Finally, the principals and the administrative team will bring the school system data analysis process back to the school building to engage all teachers in the same steps. The more the analytic process involves the school-level faculty in driving and facilitating the data analysis, the more the faculty will take ownership of the results to reflect the envisioned context of the school system under study.

Set Science Goals

Once the data are analyzed, the school system leaders and the principals will set goals. For the school system leaders under study to make dramatic improvements in student performance on the end-of-grade science assessment, they must set ambitious goals. The science goals will implicitly convey that the school system leaders believe the students can achieve at high levels. The science teachers will rise to a higher level of teaching and understanding to lead the necessary student achievement gains (Odden, 2016). The goals set will be specific and numerical rather than ambiguous. . For the leaders in the school system under study to realize the future culture, the goal-setting used at the system level will permeate to the school level, grade level, and teacher level.

Change Curriculum and Define Instructional Practices

Throughout data and goal-setting analysis, the school system leaders will shift their focus to the instructional program to address the curriculum and resources aligned to science. Collegial conversations between school system leaders and principals will occur to address whether the current curriculum supports the new ambitious goal and, if not, the curriculum needs to change. Before the school system adopts a new curriculum, the school system leaders will engage in discussions with principals, assistant principals, academic coaches, and science teachers regarding the state's explicit vision of the science standards-based classroom instructional framework. The school system leaders will be specific when articulating with the principals that the science standards-based classroom instructional framework is the desired model to be implemented in all science classrooms.

School system leaders will hold monthly curriculum meetings with the principals to investigate other effective instructional practices in each component of the science standards-based classroom instructional framework. The critical factor to realizing the future culture is for school system leaders and principals to have a clearly articulated plan of effective instructional practices to teach the science standards and the impact instructional practices have on student achievement. The primary instructional practice the school system under study will adopt is the 5E inquiry-based approach to teaching science. The 5E stands for the five distinct stages teachers and students go through during the learning cycle: engage, explore, explain, elaborate, and evaluate.

The school system leaders and principals will investigate the science resources that align with the vision of the science standards-based classroom instructional framework and the 5E model. Principals will be required to lead the science teachers through the same process at their school building. Once principals and teachers choose a science resource, the school system leaders will procure the materials for the schools. School system leaders will support principals using the new science resources to align with the science standards-based classroom instructional framework and the 5E model to build the principals' confidence and understanding of being instructional leaders in science.

Establish Clear Priorities and Conditions

School system leaders will create clear priorities and conditions to achieve the priorities addressed. It is conventional for school systems to develop a mission and vision. However, individuals can differently interpret the mission and vision. Therefore, school system leaders will set parameters and priorities expected to happen at every school and then allow some autonomy in how the principal addresses the priorities within the parameters (DuFour et al., 2016). School system leaders will provide professional development for principals during the monthly meetings on the importance of building a shared understanding of student learning by establishing collaborative teams. Grade level teams will create and design units of studies and assessments, and data analysis protocol to address the unit outcomes, inform improved learning, and plan for reteaching and extension of the unit of studies.

Building Leadership Capacity of the Principals

During the monthly meetings with principals, school system leaders will spend time building principal instructional leadership capacity by role-playing how to lead teachers in creating a guaranteed and viable curriculum of study in science. Together school system leaders and principals will discuss the state standards and identify the essential understanding of each standard for proficient learning. Then the principals will work in teams to establish how to create sample test items from the school system's established test bank platform. Finally, school system leaders will facilitate collaborative dialogue amongst the building principals to develop a sample reteaching and extension plan. These actions will help realize the future conditions of the school system under study.

Establish Indicators of Progress

Leaders of the school system under study will establish progress indicators to monitor. Principals play a pivotal role in establishing the instructional focus of their school building (Smith and Smith, 2015). Therefore, school system leaders will hold the principals accountable accordingly. School system leaders will have instructional walks with each building principal at least three times a year to increase a collective understanding of classroom instruction. Following the instructional walks, school system leaders and principals will debrief to support principals on using the instructional walks to target professional learning and provide effective feedback to teachers on using the data to target increased student achievement. Principals will provide a school improvement progress report to a team of school system leaders at midyear and end of the year. Principals will report on the following items: How are teams formed at their schools? How often do teachers incorporate the work of the collaborative teams? The presentation will include evidence of the work mentioned in the report in artifacts and data. The meetings will conclude with a dialogue between school system leaders and other principals offering subsequent step suggestions for the principal to take back and address with the teachers.

Align Leadership Behaviors with Articulated Purpose and Priorities

I will present to the superintendent and assistant superintendent of curriculum that they often neglect to ensure the alignment of leadership behavior with articulated purpose and priorities (Smith & Smith, 2015). It is imperative for school system leaders to visibly model the commitment to student achievement by speaking with one voice. The disregard of school system leaders for the improvement process can send mixed messages to principals and impact the systemwide implementation process in moving forward. School system leaders must protect the principals and schools from competing initiatives that could derail science achievement progress from becoming the school system's culture. As school system leaders set the tone for protecting the process of raising student achievement in science, principals can create a school environment focused on student achievement. DuFour et al. stated that the longer the school system focuses on getting better, the greater the gains are in student achievement (2016).

Celebrate Small Wins and Progress

School system leaders will publicly celebrate the principals' progress throughout the year until the reorganization is considered business as usual within the school system. Kotter (2012) states that short-term wins have three characteristics:

1. The results are visible for many to see whether they are real or just hype.
2. They are clear and leave little room for interpretation.
3. The results are a genuine product of the change effort. (p. 126)

Celebrating short-term victories will reinforce the hard work of the staff dedicated to change. The celebration among the staff serves a two-fold purpose; it helps school system leaders and principals strengthen the guiding coalition as it disputes the naysayer's comments. In addition, celebrating small wins will be crucial to winning over the wavering staff to be proactive supporters.

The school system leaders will determine the parameters to celebrate short-term wins. For example, in my "As-Is" diagram (appendix A), the conditions section will be the quickest area for the school system leaders to see change and celebrate small victories during the change effort. In keeping the change effort on track, the school system leaders will constantly focus on the goal of increasing student achievement in science. Small wins will be successful when school system leaders manage the context, culture, conditions, and competencies with finesse, as solid leadership alone will not transform into success.

Assessing the Effectiveness of the Strategies and Actions

To determine the effectiveness of the strategies and action plan, school system leaders will review the school improvement plan of each school to ensure the goals created directly align with the purposes of the school system. Then school system leaders will hold meetings with each principal to address the goals and action steps in the school improvement plans. The meetings will serve two purposes: to focus on the stated priorities and examine ways system leaders can support the building plans. The meetings will occur four times a year. In addition, system leaders and principals will meet once during the summer and after each benchmark test administration to discuss action steps needing adjusting before the next meeting.

Throughout the school improvement meetings, the system leaders will constantly analyze the benchmark data for trends. For the system leaders to create successful change, they need to learn together and ensure that knowledge trickles down to the building level (Kotter, 2012). Therefore, system leaders will engage with the building principals to address the data and provide a status on whether the action steps support the data and how the curriculum supports the data. Throughout the meetings, the system leaders build leadership capacity for the principals and maintain a culture dedicated to increased science achievement. As a result, the principals will leave the meetings with a deeper understanding of school improvement and an action plan for the next meeting.

Ultimately the strategies and actions set forth will prove successful if principals and teachers meet the goals established in the school improvement plans. The leaders will see principals' priorities focused on achieving the goals of increased student achievement throughout the year. The system leaders will know the school goals and can discuss how they provided support and suggest further help needed during the meeting held throughout the year.

Involving Community Partners in Decision Making

For school system leaders to create and maintain a culture dedicated to student achievement, it must include all stakeholders. Block (2018) recommends the community needs to assemble to change the narrative from the problems to the possibilities and chosen assessments set forth by the school system leaders. The school system leaders will engage in a triannual meeting where they invite community members, business members, parents, teachers, and students to help establish the desired course for student achievement and maintain stakeholder involvement throughout the year based on the current data. During the first meeting, the stakeholders will provide a broad overview of the system's data. Then, the school system leaders will match stakeholders with schools to participate in monthly meetings targeting student achievement, action steps, curriculum, and community outreach.

System leaders will send surveys to stakeholders utilizing the system's messaging system before each triannual meeting. Surveys will pertain to the school system as a whole and individual schools. The school system and individual school personnel will post the survey link on social media pages to attract as many participants as possible. System leaders and principals will collect the data from the surveys to inform decisions at the triannual meetings, school-level community meetings, and school improvement meetings. System-level leaders will compile the data collected from the school improvement meetings and the strategic planning process with the community. The assistant superintendent of the curriculum will present the data to the board of education. Members of the Board of Education will post meeting agendas and minutes on the system website for public accessibility.

The community for the school system under study will aid the school system in achieving the goal of increased student achievement. The triannual meetings will be advertised through numerous social media outlets to provide stakeholders with prior notice of any meeting. In addition, the meetings will provide an outlet to foster open communication regarding the school system's student achievement data and a plan to correct it.

Conclusion

The strategies and actions I designed to conceptualize the change leadership plan for the potential future in context, conditions, culture, and competencies for the school system under study will provide a sustainable process to support principals in increasing student achievement in science. School system leaders will facilitate monthly curriculum meetings to offer support and guidance to principals as they become confident instructional leaders in science. Furthermore, principals will facilitate similar teacher meetings for teachers to take ownership in the process. The ongoing monthly gatherings will help ensure a sustained culture of student achievement in science.

Chapter Seven: Implications and Policy Recommendations

I am addressing the high number of students lacking proficiency on the end-of-grade science assessment in the district under study by creating a new policy for school district leaders. The new policy establishes clear priorities and parameters for building principals to address at every school. The policy contains two distinct essential topics. First, principals must have a clear vision of the direction to lead the school. Then principals need a defined plan to transform the vision into increased student proficiency in science achievement.

Policy Statement

My policy mandates that science achievement is a priority focus for leaders of Grades 2-6 in the school system. The policy includes the eight action steps to address students' proficiency in science: analyze science performance, set science goals, define instructional practices, establish clear priorities and parameters in which to act, build instructional capacity in the principals, establish indicators to monitor, align leadership behaviors to facilitate the change, and celebrate small wins (Odden, 2012, Kotter, 2012). The eight action steps I defined support principals in establishing a clear vision and implementing the vision into instructional practices. According to my policy, principals design a school improvement plan around the eight action steps and submit the plan to the system leaders by the end of August every school year. Principals must create a school improvement plan addressing the eight action steps with attached artifacts that the system leaders monitor biannually. In addition, the principals and school system leaders must have the opportunity to meet so that system leaders can provide principals and their leadership teams with a list of next steps and recommendations to be addressed by the next meeting.

I recommend this policy based on the need to increase student achievement in science. My mixed-method evaluation data showed a disconnect between principal and teacher perceptions. Principals indicated they emphasized science instruction for their teachers and felt comfortable leading science meetings at their schools. However, the teacher perception data showed that principals did not emphasize science instruction or offer suggestions for science instruction. During the semi-structured interviews in my study, all principals indicated science was third in priority behind English language arts and math. One principal mentioned that teachers did not need to teach science at the elementary level. The principals did not have a clearly articulated plan to address a vision for science. The lack of a policy requiring a plan to increase science achievement was directly visible in the downward student achievement trajectory.

As school system leaders focus on improving student achievement, the greater the gains are in student achievement (DuFour et al., 2016). As school system leaders endorse the plan, the school system under study will see a marked improvement in student achievement in science. The process fosters a school system culture devoted to providing a high-quality education to all students in science. As school leaders implement my recommended policy, they can meet the district goal for science: having the percentage of students scoring proficient on the state assessment exceeding the state average within five years.

Analysis of Needs

This section analyzes my policy recommendation in six distinct areas better to understand the policy's impact on all stakeholders. I examine the proposed policy through educational, economic, social, political, legal, moral, and ethical analyses. Even though my study took place during a national pandemic and focused only on science, I desire to use the knowledge gained in this study to impact any educational disparities creating the lack of student achievement in the school system under study.

Educational Analysis

The school system under study is a charter school system in the United States. There are ten elementary schools and one gifted program that feeds into one middle school, one junior high, and one high school. The extant data collected in 2018-2019 from the state website showed 46% of the students in fifth grade participating at the end of grade science assessment being proficient compared to the state average of 67.6%. According to the school system’s webpage, 33% of the students live in poverty, with the average per capita income for the county being $19,173 in 2018. The poverty in the county presents a stark difference compared to the state, where 21% of the students live in poverty, and the average per capita income for the state is $29,523.00. The Governor’s Office of Accountability report card showed the school system under study reported one elementary school earning a B, four elementary schools achieving a C, three elementary schools making a D, and two elementary schools earning an F. The elementary students in the school system under study demonstrated an academic growth rate behind 60% of the other school systems in the state. The Governor’s Office of Accountability reported only 58.7% of the students graduating from the school system were college and career-ready. Jones et al. stated that most students graduating from high school needed to be enrolled in minimal science classes to fulfill the high school graduation requirement (2018). As the job market demand in the realm of Science, Technology, Engineering, and Mathematics (STEM) is increasing, the school system leaders under study must make changes. Previous studies suggested a lack of substantial focus from school leaders on curriculum, no specific expectations on how to implement the curriculum, lack of administrative support, and instructional conformity are obstacles impeding science instruction (DiBiase & McDonald, 2015; Jones et al., 2018; Miller et al., 2015).

When leaders of the school system under study adopt the change plan designed in my research, they will provide a clear plan to support principals in implementing their vision for their perspective schools. Keller and Pearson noted that teachers are reluctant to use newly adopted instructional practices unless administrators provide support instruments and resources to support them (2012). The principals are the cornerstone in ensuring student achievement moves forward. The data gathered showed principals' perceptions and their actions did not always align. Therefore, school system leaders providing the eight action steps addressed in the policy will support principals in increasing student proficiency in science. When principals allocate time to developing the educational needs of teachers, curriculum programs, and conducting effective evaluations, then schools show marked improvement in student achievement (Settlage et al., 2015).

School system leaders will provide the principals with the science standards instructional framework teachers must implement in the classroom. Collaborative discussions support the principals with the teacher and student expectations in each component of science's standard-based classroom instructional framework. The collaborative discussion sessions will provide the principals with a deeper understanding of evaluating the science classroom. Then the school system leaders need to expose the principals to the 5E inquiry-based instructional design model. The five distinct stages of engaging, exploring, explaining, elaborating and evaluating will drive the teacher and student engagement within the parameters of the standard-based classroom instructional framework for science. Throughout the discussions and training, the principals will gather in-depth knowledge to understand how to implement the 5E inquiry-based model in the standard-based classroom in science while allowing the teachers the autonomy of teaching science.

My policy mandates principals ensure students are provided with the science content and instruction to make them successful at each level. The impact of this policy offers equitable access to a high-quality science curriculum for all students in the school system under study. Students become proficient in science standards allowing them to compete with their peers in other counties.

Economic Analysis

The majority of the funding leaders need to enact this policy is covered through the current salaries of the school system leaders and principals. The leaders and principals will implement the eight action steps through their regular duties. The State Department of Education’s website has robust science resources provided at no charge to school systems. School system leaders offer ongoing professional development to principals by working closely with the state's employees and the regional educational service agencies. As these two agencies are state-funded, there is no additional cost to the local educational agency or school system to utilize their services. Therefore, principals and school system leaders can attend training provided by state experts in teacher and school effectiveness. In turn, school system leaders help principals facilitate the activity in their respective schools.

Principals in the school system under study have never received funds earmarked for professional learning in their school budgets. When a principal wanted to provide professional learning for their teachers, they would need to submit a written proposal outlining the need for professional learning funds to the assistant superintendent of curriculum and instruction. The request for approval or denial relied on the assistant superintendent deeming the learning opportunity necessary. This system created a disparity of some schools receiving more professional development opportunities than other schools. In my policy, the school system provides each school with a professional learning budget based on the state's allocated funding. School leaders must designate 25% of the professional learning budget for science. The financing will change annually based on the number of students enrolled.

Every school in the school system under study is considered a Title I school based on the percentage of students who qualify for free or reduced-price lunch. Therefore, as the plan I designed is to improve student achievement, Title I funding can be used for principals to supplement the school-level professional learning designed around the targeted needs of their schools. Each school must include a science goal and action steps to address the goal. Then 25% of the Title 1 budget would be allocated for the action steps designed in the plan.

If leaders of the school system under study fail to meet the goals outlined in the charter application, the system could lose its charter status. The charter status allows the school system autonomy and flexibility from state rules to implement innovative instructional models. There is potential positive economic impact on the rural community from the recommended policy as companies decide where to move based on the talent and performance of the local school system. Parker et al. mentioned that state programs guided K-12 Science, Technology, Engineering, and Mathematics (STEM) to increase student performance in STEM (2015). According to their web page, enrollment in the school system under study continues to decline even though the county's overall population has increased. The loss of student enrollment can significantly impact the school system.

Under my policy, the school system produces students graduating college and career ready. The community, parents, and industries invest in the school system when student proficiency increases. Parents will feel confident the school system provides quality education for all students and enroll their children in the community schools. The community and industry will invest in the school district by offering internships, mentors, and active members of various school committees. Stakeholders will become active members in supporting the school system to achieve the goals outlined in the school improvement plans.

Social Analysis

Since 2017, the school system under study has earned two Ds and one C on the State Office of Student Achievement report card. The school grade profoundly impacts the rural agriculture community and businesses. The board of education hired a new superintendent in May of 2021. The new superintendent established a sense of urgency among the school system leaders and principals regarding the declining test scores, including the science test scores. Blank (2013) reported that members of the National Research Council argued that accountability and assessment in science should be equally important as other content areas to provide adequate instructional time devoted to teaching science. With the growing number of STEM-related industries moving into the area, it is pivotal for the school system's elementary principals to understand the importance of science education and its impact on the students' future.

Miller et al. (2015) highlighted that excluding science professional development contributes to intellectual poverty among students, significantly in lower socioeconomic students and English Language Learners. The school system under study reported 75% of the students qualified for free or reduced lunch, and 30% were considered English Language Learners. For the school system under study, the research by Miller et al., highlights a critical need to invest in professional development and science instruction. The proposed policy sends a strong message to both educators and the community that the school system is serious about the importance of science education. The new policy is the starting point needed to instill essential changes in classroom practices.

As building principals adhere to the school system's new policy, students become proficient in science to fulfill the community's need for STEM-related careers. As local students become proficient in science and trained in STEM careers, the community industries can fill vacancies with local students. Students begin to see the possibility of a brighter future and provide hope in breaking the generational poverty cycle. Every child deserves a high-quality education regardless of their zip code.

Political Analysis

Dating back to the No Child Left Behind Act of 2001, accountability on high-stake assessments increased how children learned and achieved. Unfortunately, the increased responsibility for testing created an unbalanced educational setting for elementary students. Since state agencies do not test science as often as the other content areas, principals deemed it less necessary than the other content areas. The effects of science not being a priority have propagated groups of students in the United States trailing behind (Parker et al., 2015). Over 50% of the principal's evaluation comes from student achievement. Therefore, principals tend to focus solely on the content areas with the most significant weights on the test. Principals may initially perceive my policy may as a top-down initiative and be skeptical of the new set of parameters and guidelines.

Legal Analysis

All the elementary schools in the school system under study receive Title I funds and must meet the Every Student Succeeds Act (ESSA) criterion. ESSA states that all students will have courses taught with high academic rigor to enable them to succeed in college and in their careers. However, the interpretation of the statement is left up to the state and local educational agencies to determine the meaning of high academic rigor and the assessment measure. The school system under study stands to lose considerable amounts of federal money and the possibility of some schools being placed under state supervision if student achievement does not improve. Therefore, the proposed policy takes a necessary step in the right direction to address high academic rigor in coursework to ensure students are college and career-ready.

The change plan, which is the foundation of the proposed policy, does not violate any legalities as the school system under study is in a non-union state. Therefore, the local educational agencies do not have to negotiate with teacher unions when implementing new policies and procedures. However, it is in the best interest of the school system to work with leaders and teachers to gain understanding and consensus.

Moral and Ethical Analysis

The proposed policy establishes a clear set of parameters in which school system leaders and principals engage to enhance student achievement in science. The state has provided science standards for every grade level from kindergarten through graduation. The science standards are not a list of suggested skills, but a set of expected standards students must master. Even though science is not a tested subject in elementary schools until fifth grade, it is morally and ethically the responsibility of the local school agency to ensure students are proficient in the science standards set forth by the state. Therefore, the proposed policy must be established and acted upon for the students in the school system to be college or career-ready.

Implications for Staff and Community Relationships

My policy directly and profoundly impacts the entire school system community. The process outlined was established to create a culture around the improvement of school achievement. The policy is an ongoing and continuous improvement cycle engaging school system leaders, building principals, and teachers. When all stakeholders are involved, the school system's culture makes instructional shifts. In the beginning, all stakeholders may resist as change is difficult (Block, 2018). However, as the process unfolds, all stakeholders witness increased proficiency in science achievement. As increased proficiency in science achievement is the result of the change plan, the community begins to take notice of the student achievement on the rise. The advanced student achievement results in the community trusting that the school system can educate their children to high levels of academic rigor to be college and career-ready.

Once the community trusts the school system's educational organization, the community rhetoric changes for the better. The increased science achievement allows community organizations to attract future business opportunities. The school system under study becomes the foundation for a strong and thriving community (Block, 2018).

Conclusion

The school system under study can attain positive student achievement in science proficiency by implementing a policy that mandates addressing leadership at both the system level and building level. The system leaders need to build the instructional capacity of the principals. This chapter identified my policy and examined the policy through six lenses: educational, economic, social, legal, moral, and ethical. I defined how school system leaders need to provide clear priorities and parameters discussed by the building principal at every school. The principals must engage in key leadership steps, analyzing science performance, defining instructional practices, and establishing indicators to monitor. Leadership will align behaviors to facilitate the change and celebrate small wins along the way.

Chapter Eight: Conclusion

I evaluated the leadership characteristics of principals and how the characteristics influence science achievement in a rural school system located in the southeastern part of the United States. The school system had 55% of the elementary school students below grade level on the end-of-grade science assessment. In addition, state leadership placed one of the elementary schools on the state's failing list due to poor science achievement. As a result of the evaluation, I provided a change leadership plan to address the failing science achievement in the school system under study. My change plan provides system leaders and principals with a positive plan to impact science achievement.

Discussion

The rationale behind the study was that 55% of the elementary students in the system under study were below grade level on the end-of-grade science assessment. Across the school system under study, the low science proficiency continues to have implications for the job market industry in Science, Technology, Engineering, and Math (STEM). As the job market industry requires more skills related to STEM, this is of grave concern as research shows the United States continues to dwindle in science as other content areas are overly emphasized (Jones et al., 2018). Through my study, I aimed to analyze the leadership characteristics of principals and how the characteristics influenced science achievement.

Using a Likert scale survey instrument, I analyzed perception data gathered by surveying principals and science teachers in grades 2-6. Principals participated in semi-structured interviews so I could gain a more in-depth perspective of the principal's leadership style. I compared end-of-grade science assessment extant data from 2019 to 2021, but state leaders could not collect data for the school year 2020, as the state did not implement testing due to the national pandemic. Through the survey and interviews, principals did not clearly articulate the importance of science, so teachers perceived a lack of emphasis and attention on science instruction. For example, in the interview one principal stated that science was not necessary at the elementary level. Only one principal included a science goal in the school improvement plan. Additionally, 63% of the principals did not budget for science as much as English Language Arts and mathematics.

In the results of my evaluation, I found teachers' perceptions did not align with the principals' perceptions in two areas: emphasis on science instruction and the principals' feedback and suggestions related to science. In addition, principals lacked clarity in their vision for science in their schools. For these reasons, I recommend that school system leaders create a policy for principals that establishes clear priorities and parameters for science instruction. Principals will create a defined improvement plan and articulate the plan to the school system leaders and building staff members. The policy outlines the eight action steps to address students' proficiency in science: analyze science performance, set science goals, define instructional practices, establish clear priorities and parameters in which to act, build instructional capacity in the principals, establish indicators to monitor, align leadership behaviors to facilitate the change and celebrate small wins. The action steps build instructional leadership capacity within the school system to provide effective feedback to improve student achievement. The educational research supports establishing goals and expectations that stretch individuals to develop school improvement (DuFour et al., 2016).

I recommend in my policy that leaders of the school system hold monthly curriculum meetings to provide principals with ongoing professional learning, targeting science instruction and instructional practices. As science instruction at the elementary level is taught in the traditional passive style of student learning, instead of a systematic delivery of science teaching practices and learning activities, the change plan is pivotal to achieving the necessary gains in science (DiBiase & McDonald, 2015; Hayes & Trexler, 2016; Rieser et al., 2016).

Based on the need to increase principals' clarity on science proficiency, I recommend the policy. I found the teachers understood the principal's priorities, and their actions followed the principal's actions. I believe the policy will positively affect the low science achievement in the school system under study. Principals will constantly be learning in monthly science curriculum meetings to build the leadership capacity to support science instruction. Increasing the principals' leadership capacity will directly impact science teachers.

Leadership Lessons

One leadership lesson I learned through this process is that improving student proficiency in science is an intertwined effort of school system leaders, principals, and teachers. Everyone in the school system is responsible for improving student achievement, from the school system leaders to the teachers. Therefore, each stakeholder needs to understand the school system's goals established by the leaders. Creating a school improvement plan must move beyond the print on the page to become an action plan where everyone understands how to implement the goals.

Another leadership lesson I learned is the educational organization at the local level does not see the global picture. Since principal evaluations are heavily influenced by how the students score on the end-of-grade assessments, their emphasis is on instruction targeting English Language Arts and mathematics. As one principal commented during the semi-structured interviews, “At the time, I was like we don’t need to teach science as it is not my top priority.” Therefore, science is only a partial priority during fifth grade as the state level assesses students during fifth grade. Principals do not see how the lack of science instruction at the elementary level impacts the student’s educational science proficiency.

The most important leadership lesson I learned is that the building principal is one of the most vital measures of how effective the school will be in improving student achievement. As the school system focused only on professional learning for teachers, the principals could not follow up with discussions or monitor the training. Therefore, school system leaders need to provide professional learning for principals to provide necessary feedback and suggestions to facilitate the change in science instruction.

I have grown as a leader as I have learned how to conduct research, analyze the studies, and articulate an effective plan to improve student achievement. Throughout the dissertation process, my writing skills have improved immensely. I feel more confident in conducting unbiased research and writing a well-articulated plan of action. In addition, I have grown to understand how to analyze, code, and triangulate data to look for themes. Triangulating data has helped me understand the importance of looking at multiple data points to increase the credibility and validity of the study. More importantly, it contributes to a better understanding of the situation.

As a leader, I will use the eight-step change plan to facilitate monthly curriculum meetings with principals, assistant principals, academic coaches, and vertical teacher meetings. I have learned the importance of communicating the plan to foster understanding of the school system's vision. It takes a collective effort, and every group needs to hear and be a part of the change plan to be effective. I have learned leaving the principals out of the professional learning and decision-making at the school system level creates a disconnect in the organization resulting in a decline in student achievement.

Conclusion

The school system under study has faced years of declining student achievement. The achievement situation has created a lack of trust within the community resulting in declining student enrollment. As system leaders focused on providing professional learning to teachers, science instruction did not improve. Principals are essential in leading change in science instruction at the schools. Therefore, the school system needs to provide the principals with professional learning to elicit science instruction changes. Every student deserves to be taught at high academic standards to prepare them to succeed in college and their career regardless of their zip code (U.S. Department of Education, 2020).

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Appendices

Appendix A

Survey Questions for Science Teachers

On a scale of 1-4, with 1 being strongly disagree and 4 being strongly agree, please provide feedback.

1= Strongly Disagree, 2 = Disagree, 3 = Agree, 4 = Strongly Agree

1. I feel confident teaching science.
2. The principal has provided me with science training.
3. My undergraduate degree provided the necessary background knowledge in science to teach the required science curriculum adequately
4. I teach science daily at my school.
5. My school principal considers science as important as reading and math.
6. I have updated science teaching materials.
7. I have lab equipment and materials to conduct experiments.
8. My principal holds professional learning communities around science.
9. Science goals are created for my school.
10. My principal emphasizes science education.
11. My principal observes science lessons in my classroom.
12. My principal provides feedback and suggestions directly related to my science instruction.

Appendix B

Survey Questions for Elementary School Principals

On a scale of 1-4, with 1 being strongly disagree and 4 being strongly agree, please provide feedback …

1= Strongly Disagree, 2 = Disagree, 3 = Agree, 4 = Strongly Agree

1. I have experience teaching science.
2. I have attended training in science in the past year.
3. Science is an essential part of my school curriculum.
4. Science is taught daily at my school.
5. I budget as much for science as I do for English language arts and mathematics.
6. I am an Elementary School Principal.
7. I am a Middle School Principal.
8. I hold professional learning communities centered around science.
9. My school has identified essential standards in science.
10. I feel confident in leading science meetings at my school.
11. My school has science scores above the state average.
12. I have ensured a science goal is included in the school improvement plan.
13. I have created a science School Improvement goal.
14. My school system emphasizes science.
15. I feel science should be taught daily in every grade level at the elementary level.
16. I feel science should be taught daily in every grade level at the middle school level.
17. My educational background provided me with a science background.

Appendix C

Semi-Structured Interview Questions for Elementary and Middle School Principals

1. How would you describe your leadership style?

2. What is your philosophy on leadership?

3. How do you determine which curriculum you give priority with funding?

4. What is your educational background? What is your degree or degree in, what do you have experience teaching or leading?

5. How would you prioritize the subjects by importance at the elementary/secondary level? Why do you prioritize in that order?

6. What content area do you prioritize your SIP and PLC process around?

7. How long have you been in administration?

8. How long have you been a principal?

9. If you could change anything about the content/assessment accountability in science, what would it be?

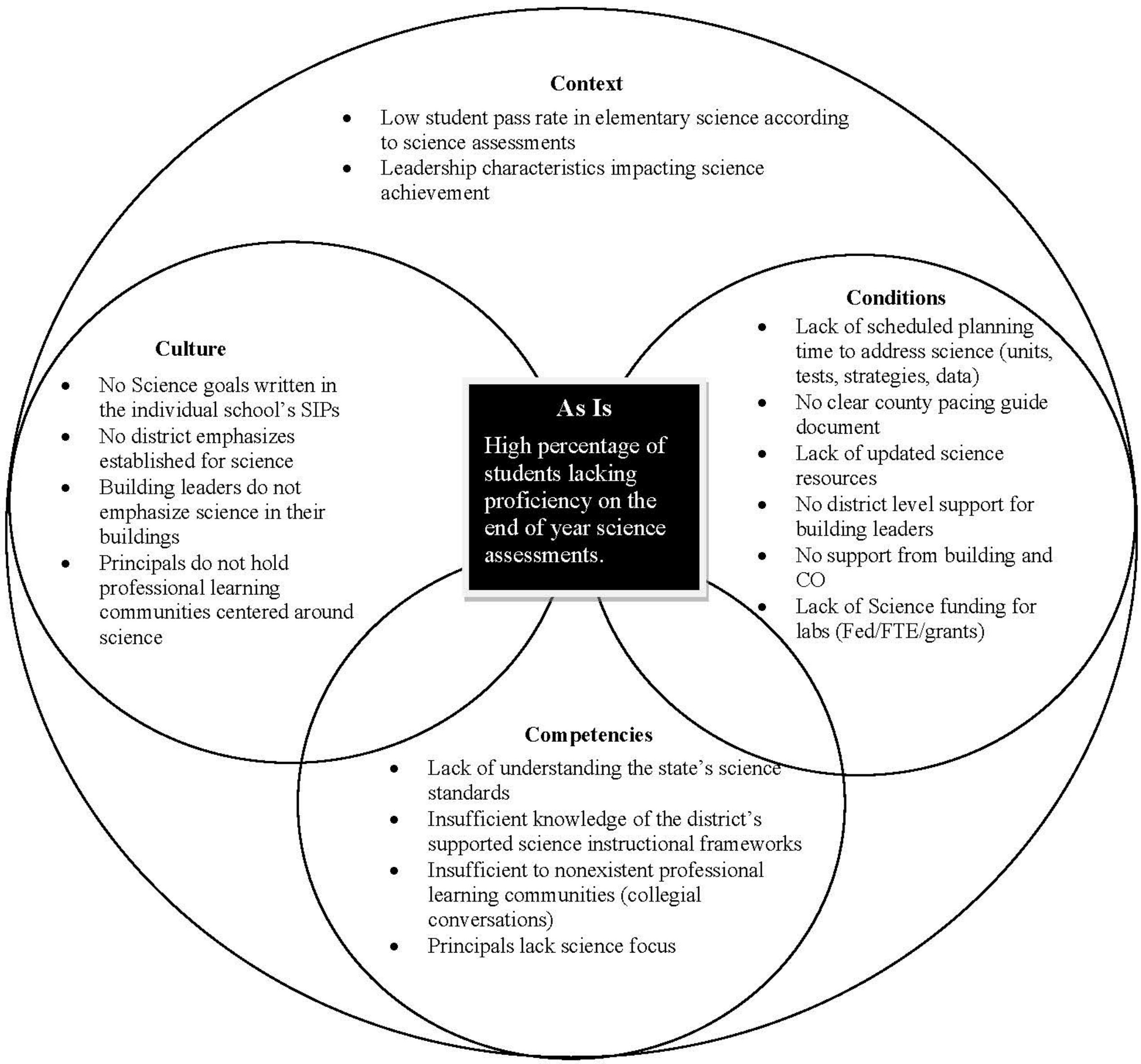
10. Do you feel the students in your building are receiving adequate instruction to be proficient in science at the next educational level?

11. Have you spoken with district leaders to identify areas on district or state assessments students are struggling within the area of science? Why or Why not?

12. How do district leaders help you identify critical need areas with science content based on district or state assessments?

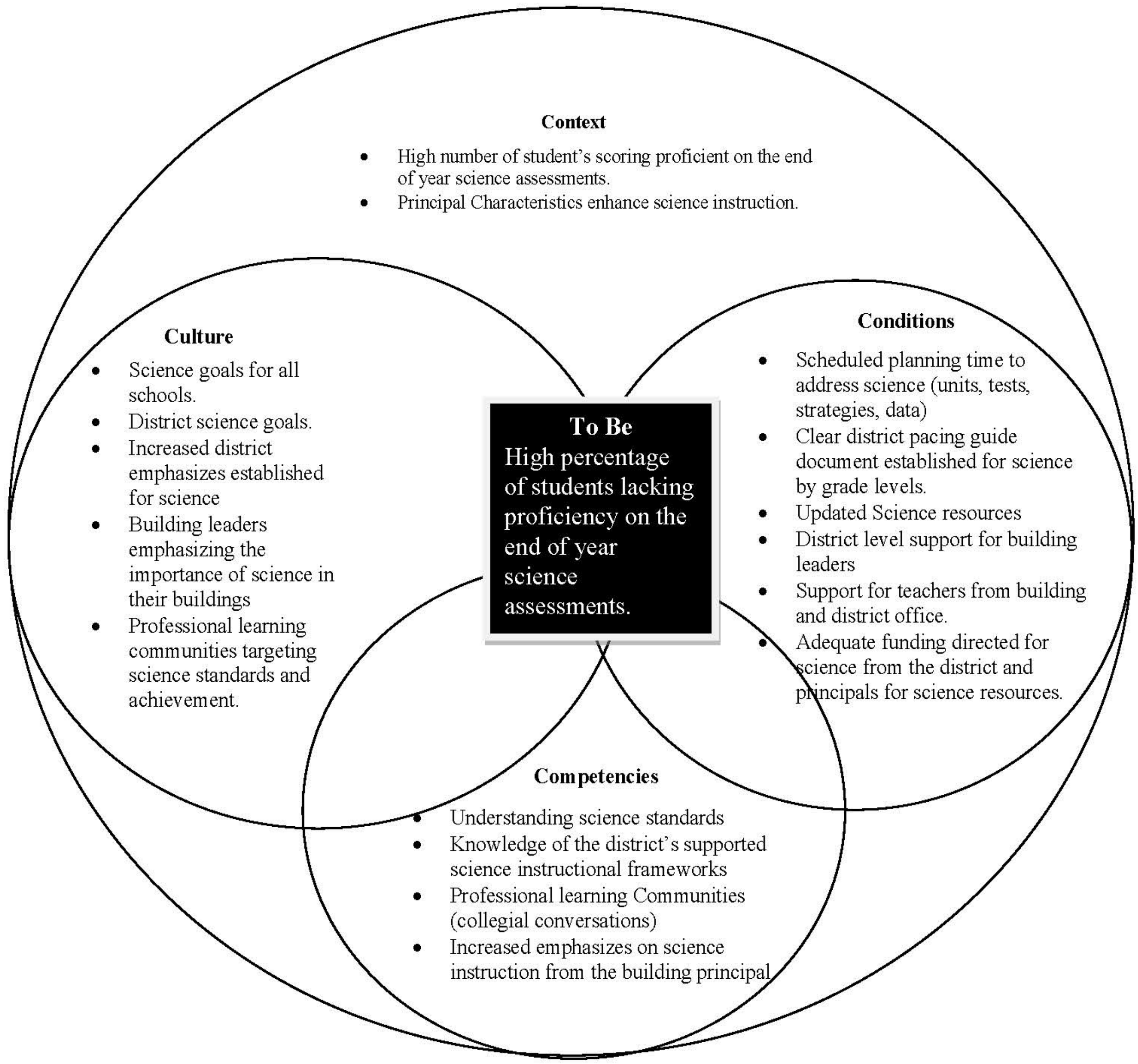
Appendix D

AS-IS Analysis for Low Science Achievement



Appendix E

TO-BE Analysis for Proficient Science Achievement



Appendix F

Strategies and Action Chart

Strategies	Action	Research
Analyze current performance situation	District leaders to meet and train principals to analyze student achievement in science.	Odden, 2012, p. 5
Set science goals	District leaders will develop a science goal for the district improvement plan. Each principal will develop a science goal for their school improvement plan.	Odden, 2012, p. 5
Change curriculum and define instructional practices	District leaders will procure updated science resources in alignment with the state standards. Principals will ensure science teachers use the district-supported science materials. The school system will adopt the 5E model of instruction for science.	Odden, 2012, p. 5
Establish clear priorities and conditions to achieve the priorities.	District leaders and principals will focus on student learning and organize staff into collaborative teams. Teams will create units of studies and assessments aligned to the studies. Teams will apply a data-analysis protocol to address the unit outcomes and inform improved learning to create a plan to address reteaching and extension	DuFour et al., 2016, p 236
Build the capacity of the principals to be confident and successful in what they are leading.	District leaders will hold monthly curriculum meetings to collaborate around the reading of books and articles, implementation changes, fiscally sound decision making, rehearsing and role-playing how to implement the expectations,	DuFour et al., 2016, p 236
Establish indicators of progress to monitor	District leaders with principals will conduct instructional walks to discuss instructional practices observed in science. Instructional walks will increase collective knowledge between district leaders and principals to support principals in providing effective feedback, support principals on how to use the walks to provide professional learning, and ongoing conversations targeting student achievement.	DuFour et al., 2016, p 236

Align leadership behaviors with articulated purpose and priorities	District leaders will protect the leaders from new and competing initiatives so principals can focus on learning and creating the environments necessary in their schools.	DuFour et al., 2016, p 236
Celebrate small wins and progress	District leaders will recognize principals publicly for progress made in student achievement at board meetings, faculty meetings, and on social media platforms	DuFour et al., 2016, p 236 Kotter, 2012