2019

Creating a Space for STEAM

Felicia Brown Pollard
University of Mississippi

CREATING A SPACE FOR STEAM

A Dissertation
presented in partial fulfillment of requirements
for the degree Doctor of Education
in the Department of Teacher Education
The University of Mississippi

by

FELICIA BROWN POLLARD

May 2019

ABSTRACT

This study investigated seven elementary teachers as they participated in professional learning communities, co-taught, and delivered STEAM instruction to students in a rural elementary school. This multiple case study analysis highlights teacher comfort in their current placement and their capacity to implement a new curriculum. The information shared in this study explores how these teachers navigated the implementation and described their experiences.

One lesson learned from this study is the difference between teacher comfort and teacher confidence. Teacher comfort comes from a place of familiarity and while positive in nature can create a teacher efficacy façade. Teacher confidence needs to be fostered for a growth mindset to lend toward true teacher efficacy. There are implications learned through this analysis for classroom teachers, teachers of STEM and administrators.

DEDICATION

This dissertation is dedicated with my deepest love and devotion to my husband, Cullen. I'm so thankful to have you by my side. To my children, Jett Boy and Crausby, you are my greatest blessings. To my mother, without you, none of this would be possible. You have been faithful in prayer; you are the standard by which I have measured all things; the greatest person I have ever known. To Him, who is the giver of all blessings, eternal thanks; great is Thy faithfulness.

ACKNOWLEDGMENTS

I express my deepest appreciation to my committee members, Dr. Joel Amidon, a trusted advisor and mentor. Thank you for your guidance. Dr. Jerilou Moore, thank you for your continual love and support; you never doubted. Dr. Susan McClelland, thank you for always dreaming my next dream with me. Dr. Ann Monroe, thank you for your honest feedback and your encouragement.

I also would like to give sincere thanks to Thomas Tillman, Dina Andrews, and Laticia James. You three are gifts from the Lord I do not take for granted; thank you for "loving me through" this process.

I would not be where I am without the Lord's faithful provision in placing people on my path that led me to this point. To Sherrod Harrison, you made me love learning. To Mary Ann Busby and Sharolyn Robbins, you taught me how teach. To Brian Jernigan and Chad Chism, you both gave me a classroom and set my path toward leadership in motion. To Dr. Adam Pugh, you pulled me from the comfort of my classroom and pushed me to be more. To Tiffany Babb, a testament to the power of prayer, you gave me laughter through the tears. To Becky Smith you gave me confidence by speaking the Truth. To Brian Buckhalter you gave me perspective. To Haley Wilson, a wonderful intern, a better mentor, an even greater friend.

And finally, to Margo Parker, Lauren Patton, Stephanie Neeley, Dana Zuniga, Arvy Allen, Kathleen Hamilton, and Katie Goodwiller, thank you for opening your classrooms and giving your time.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

INTRODUCTION

Since the launch of Russian satellite Sputnik in 1957, Americans have been engaged in competition to create more scientific advances, to find greater uses of technology, and to achieve higher distinctions than other world powers. Science, technology, engineering, and mathematics (STEM) fields draw increased attention from institutions of higher learning and the federal government. A missing piece of the puzzle lies in the integration of art into the of design of STEM education. The crux is how to move from STEM to STEAM. Leading the charge, President Barack Obama set an ambitious goal to prepare 100,000 STEM teachers between 2011 and 2021 (Committee on STEM Education National Science and Technology Council, 2013). Allocating funds to encourage and lure students into STEM fields is not sufficiently meeting the needs of learners. By reframing our thinking from merely focusing on traditional fields of study, greater enrichment and success can grow from an arts integrated STEM program of study. STEAM curriculum, as outlined by Riley (2014), a prominent STEAM enthusiast, "is an educational approach to learning that uses Science, Technology, Engineering, the Arts and Mathematics as access points for guiding student inquiry, dialogue and critical thinking" (p. 22-23). Without art integrated practices, are practitioners limiting student creativity, thus producing a generation of test takers rather than problem solvers or creative thinkers?

Background of the Study

STEM was born the idea science, technology, engineering, and math are interrelated and should be taught in an integrated way. The term STEM was coined by the National Science Foundation in the early 2000's and has become a prominent word in education. STEM learning perpetuates the need for a workforce trained in science, technology, engineering, and math. The Common Core Standards (National Governors Association Center for Best Practices, Council of Chief State School Officers, 2010) and Next Generation Science Standards (NGSS) seek to integrate the standards across the curriculum not to teach skills parallel to one another, but rather to strengthen the content understanding of all subject areas (NGSS Lead States, 2013). In response to the lackluster National Assessment of Education Progress (NAEP) scores in 2009, science organizations developed the Next Generation Science Standards to better prepare K-12 students for science careers (Sousa & Pilecki, 2013).

The problem is clear it is now time for a change to occur. New standards will not raise a generation of 21st Century thinkers; new standards only provide teachers with a guide. To create a generation of students able to adapt, plan, and problem solve, teachers need to provide students with multiple opportunities from a young age to design solutions to real world problems. Students need opportunities to collaborate with classmates, to communicate their thought paths and to couple their learned knowledge with creative design in order to answer relevant questions and form or become aware of new questions they must seek to answer.

STEM education is in need of arts integration. Integrating the arts is the answer to creating a collaborative culture in our classrooms and our schools. "Arts integrated lesson plans innately promote a collaborative culture within schools and classrooms" (Sousa & Pilecki, 2013 p. 75). How do we nurture students who build relationships with others and use those

relationships to leverage learning and problem solving? STEAM is the answer. The arts contribute to the education of young children by helping them realize the broad scope of the human experience (Sousa & Pilecki, 2013).

Statement of the Problem

The need for this study persists from the lack of information in current literature. With STEM education coming to the forefront of educational research in the past decade, the idea of integrating the arts to enhance STEM delivery is relatively new to researchers. An increased focus on traditional curriculum, coupled with the majority of districts' monies supporting and undergirding classroom skills taught by general education teachers, the arts are supplementary and taught in isolation for thirty minutes once a week. Classroom teachers provide the bulk of any instruction in arts and music, which places students and teachers at a disadvantage.

It is commonplace to find teachers practicing in isolation and focusing their instruction on the tested standards. From an educational perspective the key component when trying to conceptualize STEM, is integration. Integrating the arts combines at least one other subject; math, science, social studies with an arts subject; music, art or dance to develop a blended curriculum. Arts integration provides students with the opportunity to engage in the material they are learning while having the ability to express themselves thus developing their creative problem-solving skills (Cornett, 2006; Nixon, 2013). When art instruction is well planned and taught with fidelity, it can develop students' cognition, helping them to memorize, analyze, and make connections. The gaps in the literature fail in finding what quality STEAM instruction looks like. How are teachers supported in the planning and teaching of STEAM? How is STEAM effectively taught well? How is STEAM effectively assessed well?

Purpose Statement

The purpose of this study is to explore the implementation of STEAM curriculum in a rural elementary school, examine teacher pedagogical practices, evaluate the curriculum influences on teacher development, teacher motivation, and teacher results of common planning. This study will follow seven teachers, one STEM teacher and six classroom teachers, as they implement STEAM within their classroom. Bringing to light the strengths and weaknesses of the current program of curriculum in comparison to the implementation of STEAM practices, participants will identify areas of improvement. This study's findings will present practitioners' perspectives of implementing new strategies and practices to enrich current programs within an elementary school. Practical, action-oriented questions will guide the inquiry and aid the researcher in the formative evaluation of previous and newly implemented practices and will provide information to improve practice. Supported by time, people, and access to participants, data collection will consist of interviews, PLC meeting transcripts, reflective journals, field observations, and student work as sources of information.

Research Questions

The following questions will guide the development of the study.

1. What does creating space for STEAM look like in an elementary school?
2. How do teachers describe their experience of learning to teach with and through STEAM?
3. How do teachers' perceptions and experiences help to understand the potential contributions of the arts?

The qualitative study aims to conduct focused research on teacher practice through co-teaching, professional learning communities, and reflective practice.

Limitations and Delimitations

Limitations are possible problems, faults, or weaknesses in a study, which can be related to limited sample size, or other factors that may impact data (Creswell, 2013). Existing literature lacks specificity of what STEAM is beyond STEM with the arts. In this multiple case study, the size of the sample is one limitation. With limited number of perspectives, it is impossible to gain all insight needed to fully define and describe the lived experiences of teachers attempting to create a space for STEAM education. Creswell suggests a smaller size, for multiple case study; however, the limited number will hinder the generalizability of the study (2013). Using a variety of data will help to lessen the limitations to the study. Observations taking place in the classrooms of the teacher participants are subject to limitations. The presence of a critical friend might alter the actions of those being observed. For the purpose of this study a critical friend has been identified as the research site administrator. As defined by Costa and Kallick (1993), a critical friend is a trusted person who asks proactive questions, providing data to be examined. Researcher presence during professional learning community meetings might alter teacher response and act as a limitation; to prevent this, audio recordings of the sessions will be gathered rather than researcher observations. Interview limitations include potential distortion of responses due to personal bias, teacher attitude at the time of interview, and the pressure of performance being interviewed by a supervisor. As identified by Patton (2002), using a variety of sources and multiple approaches will minimize the weakness present with single approach collection and create strength through triangulated methods. The short timespan planned for this study might also be identified as a limitation. The nine-week time frame will mirror the grading period of the research site and will work to support the established scheduling framework of the teachers so as not to hinder teacher practice. From the initial interview until the final interview,

nine weeks might not allow participants to fully grasp meaningful insights to creating and utilizing the most influential STEAM practices (Patton, 2002).

A delimitation of the study is the lack of student perceptions creating a space for STEAM. Focusing singularly on the teachers' perspectives, the researcher has a one-sided description of the phenomena. This study is further delimited to a specific population of teachers with at least three years of experience. To study this small bounded system of teachers, this study is from one research site. While the research design calls for this small, purposeful sample, it remains a defined border of the study (Smith, 2018).

Definition of Terms

Arts Integration- an approach to teaching in which students construct and demonstrate understanding through an art form. Students engage in a creative process which connects an art form and another subject area and meets evolving objectives in both (Silverstein & Layne, 2010).

Co-Teaching- the practice of more than one teacher sharing planning, organization, delivery and assessment of instruction; merging physical and/or virtual space of instruction (Dow & Thompson, 2017).

STEM- an acronym for the disciplines of science, technology, engineering, and mathematics

STEAM- "an educational approach to learning that uses Science, Technology, Engineering, the Arts and Mathematics as access points for guiding student inquiry, dialogue and critical thinking" (Riley, 2014, p. 22-23).

Professional Learning Community-working collaboratively in recurring cycles of collective inquiry and action research to achieve better results for the students they serve (DuFour, DuFour, Eaker, & Many, 2006).

Significance of the Study

Questions will always remain if the arts are worth the investment in public education. Will funding the arts provide the same return as funding smaller teacher to student ratios or providing the latest technologies to teachers and students? This study seeks to provide a model for how teachers plan and co-teach integrated lessons using STEAM practices as their vehicle for teaching elementary students Next Generation Science Standards. While many schools in rural North Mississippi have used the Mississippi Arts Commission Whole Schools Initiative to integrate arts into curriculum, no research exists on the practice of an arts integrated STEM curriculum.

Organization of the Study

Chapter I includes a general overview, statement of the problem, purpose statement, research questions, limitations and delimitations. The chapter concludes with definition of terms, significance of the study, and organization of the study. Chapter II reviews the related literature and begins with a historical perspective of arts education outlining benefits of arts integration and reasons it is not prioritized in much of public education. Next, a historical perspective of STEM and the important takeaways from STEM instruction are the focus on 21st Century skills and problem-based learning experiences for students. Chapter II concludes with a look at STEAM and how an introduction of the arts into STEM curriculum partnered with a co-teaching model, professional learning communities, and continual reflective practice, help create a sustainable model for STEAM in elementary schools. Chapter III is the methods section and includes purpose of the research, research questions, site demographics, and design of the research study. The chapter concludes with information regarding the interview protocol and data collection and data analysis.

CHAPTER II

REVIEW OF LITERATURE

Chapter II examines the literature related to arts integration, STEM, and STEAM. The arts integration literature includes historical perspectives, benefits and the resistance of arts integration. The rise of STEM portion of the literature review offers a historical trajectory of how STEM developed, the focus of 21st Century skills, and problem-based learning. The STEM segment leads into how STEM is evolving with the induction of the arts to create STEAM. The STEAM literature review outlines domain integration, co-teaching, and professional learning communities to increase sustainability and closes with a section on reflective practice to create a continual refinement of practice to ensure relevance and rigor.

STEM

STEM is an acronym for science, technology, engineering, and math. STEM curriculum blends these subjects to teach students 21st Century Skills, or skills they will need, to be successful in the workplace of the future. The variety of definitions for STEM exist impart to the "variety of approaches of research and initiates created to address the need for the United States to compete globally" (Breiner, Harkness, Johnson, Koehler, 2012, p. 3). But what does STEM look like? With the increased STEM initiatives in schools often resulting in more mobile devices for students or after school clubs or programs, STEM programs are actually STEM enhancement. However, providing STEM resources or a set time and place for STEM experiments and practices is a disservice to STEM (Riley, 2014). From an educational perspective the key component when trying to conceptualize STEM, is integration. It is a blended approach to

teaching specific domains which encourages collaboration, hands-on experience and gives learners the opportunity to apply knowledge to real world challenges. To truly make an impact with STEM, students need to take what they know and connect it intentionally through lessons that are framed in inquiry, problem-solving and creative applications (Riley, 2014).

Evolution of STEM. The launch of Sputnik and the start of the great Space Race resulted in a turning point for science education in the United States. It propelled practitioners to make changes and focus the attention for our nation's young to science and math driven fields. Based on the idea, science, technology, engineering, and math are interrelated and should be taught in an integrated way, STEM was born. The term STEM was coined by the National Science Foundation in the early 2000's and has become a prominent word in education. STEM learning perpetuates the need for a workforce trained in science, technology, engineering, and math.

The National Defense Education Act of 1958 passed in response to the launch of the Soviet Union's satellite, *Sputnik*. This act sought to address concerns about existing imbalances in our educational programs specifically in the areas of science, mathematics, technology and foreign languages. The act provided student loans to students in the aforementioned areas, gave funds to state programs aimed at instruction in those areas, and provided grants to states with programs to identify and encourage gifted students (Granovskiy, 2018, p.23). Then, in 1965 the Elementary and Secondary Education Act became the primary source of federal aid to K-12 schools, providing funding for curriculum and additional classroom needs. The act was recently amended and included in Every Student Succeeds Act, and while STEM was not part of the act originally, it was included in the reauthorization in 2015. To further fund and promote STEM education, The America COMPETES Act of 2007, and America COMPETES Reauthorization Act of 2010 authorized a variety or STEM education programs. In 2011, the Economics and

Statistics Administration from the Department of Commerce stated from 2000 to 2010, the growth in STEM jobs was three times greater than that of non-STEM jobs (Committee on STEM Education National Science and Technology Council, 2013). The Department of Commerce also estimates that in the coming years STEM occupations will grow 1.7 times faster than non-STEM occupations. Georgetown University's Center on Education and the Workforce projects that America will create 779,000 jobs between 2008 and 2018 that require a graduate degree in a STEM field but, based on current trends, only 550,000 native-born Americans will earn STEM graduate degrees during this period (2013). "By 2018 there will be 1.2 million job openings in the STEM fields which will go unfilled due to the significant shortage of trained and qualified applicants" (Committee on STEM Education National Science and Technology Council, 2013, p1). How do we prepare a workforce for these jobs? In a 2013 address, President Barack Obama said at the 2013 White House Science Fair.

> One of the things that I've been focused on as President is how we create an all-hands-on-deck approach to science, technology, engineering, and math. We need to make this a priority to train an army of new teachers in these subject areas, and to make sure that all of us as a country are lifting up these subjects for the respect that they deserve (Committee on STEM Education National Science and Technology Council, 2013, p.vi)

How do we mobilize all-hands-on-deck? The Federal Strategic Plan hoped to approach agencies to leverage support for a coordinated effort. With the Every Student Succeeds Act signed into law by President Obama in December of 2015, STEM education provisions allowed salary bonuses and professional development opportunities to outstanding teachers of STEM subjects. Next, the American Innovation and Competitiveness Act was signed into law in 2017 with several provisions for STEM education but was particularly focused on grants and monies

allocated to populations underrepresented in STEM fields. This act directed the National Science Foundation to expand grant programs, encourage grant programs for STEM apprenticeships and promote undergraduate research opportunities in STEM fields by recognizing outstanding mentors (Granovskiy, 2018, p.26).

The previous historical overview of STEM interventions made by the government seeks to provide perspective. Broad reaching attempts have been made to address the need for STEM. These efforts include between 105 and 254 education programs and 15 federal agencies, with annual appropriations between $2.8 billion and $3.4 billion. Through investigations these federal agencies responded to support STEM pathways development in the following ways: a) to improve STEM instruction by better preparation and development of STEM teachers in practice and pedagogy, and by providing better resources in the forms of courses and curriculum for teacher; b) to increase and sustain public engagement by direct support of students in STEM fields through scholarships and fellowships; c) enhance STEM experiences for undergraduates to garner interest; d) serve groups historically underrepresented in STEM fields, and e)design and develop graduate education programs to extend STEM opportunities. All of these priorities were to be supported and marketed for public education through websites, publications and public events to build energy and excitement for STEM learning (Federal Report, 2013).

How is STEM being taught in schools? The funding of STEM programs through initiatives and partnerships reveal two major considerations when implementing STEM curriculum at the k-12 level: (1) instructional strategies have not changed and (2) students have not gained more interest in the STEM subjects (Breiner, Harkness, Johnson, Koehler, 2012). The common implementation route for STEM in schools is through the focused instruction in the specific subject areas of STEM. Leading teachers to instruct these disciplines in a silo model with little to

no integration between the subject areas each being taught in isolation preventing students from seeing the connection between content and with no relevance for the learner (Maslyk, 2016). What skills are fostered and nurtured by STEM and engaging to public interest which are not nurtured through traditional curriculum?

21st Century Skills. The need for 21st century skills is real, according to Geisinger. He suggests the transition from job skills needed in 1999 to 2000 or even to 2020 is a gradual shift, but the skills are new and must be built into curriculum, taught, and assessed in education and elsewhere (2016). The Partnership for 21st Century Skills (2009) Framework Definitions states that a student's future life and work environment will require far more than thinking skills and content knowledge. "The ability to navigate the complex life and work environments in the globally competitive information age requires students to pay rigorous attention to developing adequate life and career skills" (p. 6). These 21st century skills in social interaction are delineated as (a) flexibility and adaptability, (b) initiative and self-direction, (c) social and cross-cultural skills, (d) productivity and accountability, and (e) leadership and responsibility (French, McDuffie, & Morrison, 2015). What we learn, the way we learn, how we learn, and how we are taught are changing. The common thought of a strong foundation in basic skills dominated the 20th century. 21st Century skills go beyond the traditional curricular of reading, writing, mathematics, history, and science and focus on cognitive skills, intrapersonal skills, interpersonal skills and technical skills. These focused categories are an approach suggested by the Organization for Economic Co-operation and Development (Schleicher, n.d.; Ananiadou & Claro, 2009). These 21st Century skills are conceptualized within three overarching dimensions: information- as a source and as a product; communication- written, spoken, virtual, art, collaboration, and using information communication technology; and ethics and social impact-

social responsibility, critical thinking, decisions/ judgment and social awareness (Geisinger, 2016). It no longer will suffice for students to produce more of the same knowledge and skill. Teachers once believed the information they taught students would last them a lifetime. Social changes and rapid economic development in today's world create a system in which teachers must prepare students to hold jobs which have yet to be created, to use technologies yet to be created, and to solve problems society does not know will arise (Schleicher, n.d.). Education must shift from teaching students how to acquire knowledge to teaching students how to use knowledge (Lapek, 2017). Students must be provided opportunities to develop life and career skills.

While we live in a revolutionary time, which demands new and different abilities for students to be college and career ready, critical thinking and problem solving are two components present throughout history. What is actually new is the extent to which economic and individual success depends on having such skills (Rotherham & Willingham, 2009). If these skills were new, then we might need an educational overhaul, but like Rotherham and Willingham suggests, we need to focus on creating a system of high-quality education, where students encounter great teachers, with critical thinking skills, collaboration, and problem-solving skills that are taught intentionally and in real world scenarios (2009). Looking at the instructional content to maintain the highest level of student engagement we should look at the dimension of problem-based learning delivery, discipline integration and the problem-solving skills required to apply the content being taught (Quigley, Herro, & Jamil, 2017).

Problem-Based Learning. How do teachers shift the focus from traditional curriculum to engage students in meaningful experiences that foster and build knowledge of how to be responsive to the world around them? Problem-based learning will help students develop their

own ideas (Lapek, 2017). Problem-based delivery of instruction frames learning in a problem or issue where there is no one correct answer. "Research suggests that solving such problems helps learners understand there are multiple ways of solving which fosters multiple types of problem solving skills such as creativity and collaboration" (Quigley, Herro, & Jamil, 2017, p.5). Jensen suggests all cognition is built from lower-order brain systems, including sensory/motor systems, auditory/language systems, social and emotional systems, and memory systems to name a few (p. 112). Humans are not born smart; these systems must be coaxed into cross modality to perform at high levels (2005). Critical thinking skills take time to learn. Learning new skills literally reorganizes the brain. The higher order thinking skills required in problem-based learning is crucial to the development of 21st Century Skills (French, McDuffie, Morrison, & Roth, 2015). Problem-based learning teaches students to think for themselves. Unlike traditional teaching practices in which students are to find one solution, problem-based learning encourages students to identify resources such as tools and materials they need to successfully solve problems that arise (Lapek, 2017). Problem-based learning experiences offer a few nuances which aid in developing needed thinking skills. Jensen suggests coherent, challenging learning best aids in skill development, offering students tasks which move from skill specific to generalizable help position students to relate learning to real life experiences (2005, p.118). It is clear what types of learning practices need to be implemented to create engaging and valuable learning experiences, but how do these experiences fair with assessment being the driving factor of educational funding allocations?

Assessment. State and federal testing coupled with district and local standardized assessments are common practice in the primary grades. In spite of the large investments of time and money, few can demonstrate mastery of these 21st Century skills that have been identified as

critical to student success (Burdette, 2011). At the school level, assessment is an ongoing problem. Are teachers creating fair assessments, is still a challenging question to answer. If assessment is measuring or trying to "read" what is in a student's brain, Jensen suggests we as a society have a long way to go (p.152). Limiting education to the search for the right answer, as is common practice when the focus of assessment is on standardized testing, violates the law of adaptability of the developing brain. He offers quality education that encourages a wide-open, creative problem-solving approach, exploring alternative thinking options, multiple right answers, and creative insights (2005, p.153).

The needs have been identified, funds have been allocated but years after the strategic plan was written results have not been seen. What are the findings? Did the allocated funds close the gap? Was the strategic plan the solution for the problem? According to *Congressional Research Service Science, Technology, Engineering, and Mathematics (STEM) Education: An Overview* over half of federal STEM education funding is intended to serve postsecondary school students in the form of grants and financial aid and the remainder for K-12 education (Granovskiy, 2018). An effort needs to be made to reach younger students. Contrary to how the money is being allocated, a 2013 study stated students who have earlier exposure to STEM education are much more likely to complete a college degree within a STEM field (Wang). Educators should focus attention on young learners and expose them to exciting and engaging STEM experiences. The achievement gap between the U.S. achievement and other countries' achievement in mathematics and science remains a persistent issue. According to an international assessment the science scores of U.S. eighth graders were surpassed by eighth graders in Singapore, Chinese Taipei, and Korea. The same study reported African American and Hispanic eighth graders had science scores equivalent to students in the bottom third of the

45 countries reporting scores. Fewer than 40 percent of students who enter college intending to major in a STEM field complete a STEM degree. Only 19 percent of U.S. bachelor's degrees are awarded in STEM fields, while in China over 50 percent of first degrees are awarded in STEM fields. Roughly 30 percent of chemistry and physics teachers in public high schools did not major in these fields and have not earned a certificate to teach those subjects. It is apparent the answer does not come in the form of more money spent in more fellowships and scholarships for college bound students. Inadequacies in education pathways leading to STEM degrees and into the workforce, amplify concerns that the United States is failing to keep pace with its international competitors in producing a workforce with the necessary skills and knowledge to advance STEM fields. The U.S. Government Accountability Office Report to Congress to assess the federal investment found from 2010 to 2016, the number of STEM education programs decreased while spending remained stable, and the majority of programs overlapped (2018). While the strategic plan hoped to create an inclusive society where both women, men, and minority groups were equally represented in the STEM fields, the 2018 study found efforts to assess programs which were created to support underrepresented groups were limited. Of the 163 programs followed by report, 120 reported tracking participants in 2016. Of those programs 73 of them tracked if the participants were women and 65 of the programs captured those who were African American. While it was noted in the strategic plan as a priority investment area to better serve groups historically underserved, assessment and reporting are lacking. The Committee on STEM Education and Office of Science and Technology Policy have not fully met their responsibilities to assess the STEM education portfolio. Overall, the Committee made limited progress advancing its strategic goal of increasing the use of evidence- based approaches

because, according to Committee leadership, they focused on achieving other strategic goals (United States Government Accountability Office, 2018)

While some see STEM as a fad, practitioners who have been a part of initiatives over the years know they are not stagnant; they grow and change. Now that STEM has been established as a necessary focus, it has begun to transform. Deficits have been identified. Monies are being funneled into programs, but scores on achievement tests are not increasing. Programs are halting and new ones are being created, yet they are not producing change. How is it we can keep the integrated focus of STEM yet speak to the creativity and design development of learners to become 21st century problem solvers? With the focus on STEM education rather than STEAM education, are practitioners missing an integral design piece, which could have an effect on student achievement? To prepare students for the real-world experiences they will face and provide them with divergent thinking skills, we add the arts to STEM.

Arts Integration

Arts integration as defined by The Kennedy Center is an approach to teaching in which students construct and demonstrate understanding through an art form. Students engage in a creative process which connects an art form and another subject area and meets evolving objectives in both (Silverstein & Layne, 2010). Integrating the arts combines at least one other subject; math, science, social studies with an arts subject; music, art or dance to develop a blended curriculum. Arts integration provides students with the opportunity to engage in the material they are learning while having the ability to express themselves thus developing their creative problem-solving skills (Cornett, 2006; Nixon, 2013).

In the 1930s and 1940s, arts were to be appreciated as enrichment or primarily for study by the gifted and talented. In the 1950s, visual arts were taught in secondary classrooms by

specialists in the field or by teachers in elementary classrooms. By the 1960s, President Lyndon B. Johnson introduced legislation for the Great Society, a national effort to improve economy, fight poverty, advance education and support the arts. Under his leadership President Johnson renamed the National Center for the Arts the John F. Kennedy Center for the Performing Arts. This marked the first time national leadership and federal legislation provided money for educational programs using the arts. Partnerships between local art guilds and endowments with schools to foster relationships and heightened art awareness became popular in the late 1960s. The 1970s brought forth competitive grant writing to secure funding for projects supporting arts education. With the Carter, Reagan, and Bush administrations in the 1980s, arts in education became an economic drain, and programs began to face cutbacks, forcing schools to look for private donations to keep programs funded. In 1994 with the introduction of the Goals 2000: Educate America Act, the arts gained recognition as a core subject for the first time. National Standards in art, music, dance and theater were written. With standards present and new attention given to subject accountability, some state and local agencies began to look at their teacher preparations and professional development practices. The early 2000s brought about an economic downturn which cut educational funding. The No Child Left Behind Act included the arts as a basic subject. State and local agencies began encouraging teachers to reach out to local artists and specialists to develop partnerships and lead professional development to forge instructional partnerships (Remer, 2003).

An arts integrated curriculum promotes student engagement (Sousa & Pilecki, 2013). Sousa and Pilecki (2013) cite four research-based reasons to integrate the arts: to (a) engage the brain and develop cognitive growth, (b) improve long-term memory, (c) promote creativity, and (d) reduce stress. Practitioners are often searching for ways to motivate students

and promote engagement, the arts do both. The late Elliot Einser, a leading researcher in arts integration, believed the arts were the most effective way for children to learn about relationships, express themselves given constraints or rules, notice life's subtleties, express feelings, exhibit flexibility, learn to think in pictures, to experiment and discover to find ownership in learning, to understand there are often multiple paths to the answer, and to find purpose in the journey to learning (Cerveny, 2001). The arts have value in education. The arts help to create learning environments that are supportive, enriching, and happy. The idea of Socrative classrooms where interdependence among learners is prevalent has long been used successfully by choral, instrumental, and dance educators, and the method can be embraced in general education classrooms as well (Sousa & Pilecki, 2013).

The main objective of art is discovery (Sousa & Pilecki, 2013) Art immersion provides an outlet for students longing for a connection. Art immersion provides success and evens the playing field. Using the arts to reach students and engage them in conversations of equality, core beliefs, and values can be the greatest gift an educator can provide society. "Schools have an obligation to expose children to the arts at the earliest possible time and to consider the arts as fundamental- not an optional- curriculum area (Sousa & Pilecki, 2013, p.15). Riley states "a beautiful element to arts integration which cannot be overlooked is its capacity to unlock each student's unique access point to creativity and understanding of the world around them" (2013, p. 21). What is it about the arts that engages students?

"The arts are a collection of skills and thought processes that transcend all areas of human engagement" (Sousa & Pilecki, 2013, p. 17). Children who begin participating in arts training at an early age benefit by improving cognitive growth while their brain is still developing (Sousa & Pilecki, 2013, p. 19). The human brain is divided into two hemispheres,

connected by a thick cable known as the corpus callosum. This cable allows information to travel between the hemispheres allowing a person to benefit from whole-brain participation. Conventional thought in recent years is each hemisphere performs different tasks in information processing. Our left brain monitors areas for speech, understands literal interpretation of words, and recognizes words letters and numbers. The right hemisphere gathers information more from images and looks for visual patterns, specializing in spatial perception (Sousa & Pilecki, 2013). While common thought sensationalized by the media since the original study was completed is to determine whether people are more "right-brained" or "left-brained" based on their personality traits, there is no neuroscientific evidence to support the notion has been found (Sousa & Pilecki, 2013, p. 40). "Anatomically, the corpus callosum connecting the two hemispheres facilitates communication between them, forcing them to work together when taking in information giving us a complete picture of what is happening" (p. 40).

If integration is the key to exposing children to the arts, what does it look like to integrate art?

From STEM to STEAM

"STEM jobs are growing approximately three times as fast as non-STEM occupations" (Anttila, Barrett, Haseman, & Ruthmann, 2015, p. 4). This calls for a need of strong STEM education programs, yet many entering STEM majors do not complete their training. "Only 43% of students that enter a four- year institution with a declared STEM major actually graduate with a STEM degree (Anttila, Barrett, Haseman, & Ruthmann, 2015, p. 5). STEM education is in need of arts integration. Integrating the arts is the answer to creating a collaborative culture in our classrooms and our schools. "Arts integrated lesson plans innately promote a collaborative culture within schools and classrooms" (Sousa & Pilecki, 2013 p. 75). How do we create students who build relationships with others and use those relationships to leverage learning and

problem solving? STEAM is the answer, the arts contribute to the education of young children by helping them realize the broad scope of the human experience (Sousa & Pilecki, 2013). Artistic inquiry promotes rigor and creativity while allowing the teacher to use multiple avenues to reach learners creating stronger retention. "In addition to improving learning, the core content, arts integration can be engaging and bring joy to learning" (Anttila, Barrett, Haseman, & Ruthmann, 2015, p. 5).

"Arts-based teaching leads to motivated, engaged and effective learning in STEM subjects" (Maslyk, 2016). Art is not merely an add on, rather an essential part of the process. The multisensory, hands-on nature that the arts can bring to STEM lessons helps students to connect to the content. Learning becomes personal when students include an artistic element (Maslyk, 2016).

Initial findings indicate that STEAM-based curricula increase motivation, engagement, and a broader diversity of students interested in careers in math and science (Kang, Park, Kim & Kim; Quigley, 2016) When art instruction is well planned and taught with fidelity, it can develop students' cognition, helping them to memorize, analyze, and make connections. What do STEAM practices look like? Riley (2014) outlines four practices common to STEAM instruction: 1) a deep connection to an arts standard, process or skill, 2) the use for the strategy is clearly evident, 3) the strategy unfolds sequentially leading to higher cognitive demands, 4) the "doing" is placed within the students' hands, not the teachers. To gain better insight into the most effective STEAM practices, we can look at how STEM programs are falling short. According to Riley, a missing piece of the STEM success comes from the lack of integration. Practitioners are presenting the STEM subjects individually rather than in tandem, thus omitting a valuable part of the process needed for greater understanding through critical thinking. An arts

integrated approach has the ability to present content in the areas of STEM through the vehicle of art, assessing each equitably and providing students deeper personal understanding in all content areas taught (Riley, 2014). As standardized tests begin to include performance-based measures, teachers struggle to find resources and assistance to help prepare students for application of content rather than traditional identification of the correct answer. STEAM practices enhance student ability to creatively assess a problem and then formulate a solution.

Lesson Integration. "Arts integration is an instructional approach in which the teacher uses the arts to help students constructing meaning and demonstrate understanding in both the particular art form and another subject area" (Sousa & Pilecki, 2013). Allowing for creativity, collaboration, and critical thinking STEAM helps learning move from convergent thinking to divergent thinking (Maslyk, 2016). With STEAM instruction, there are two major types of thinking in which students participate- convergent and divergent. Convergent thinking works best with well-defined problems with definite answers. Divergent thinking occurs when students are asked to generate several ways to solve a problem. While convergent thinking might ask for a specific answer for example, "Determine which of the three bridge models can safely carry the most weight." a divergent task might ask a student, "Think of as many uses as you can for each of the following: a paper clip, a blanket, a brick" (Sousa & Pilecki, 2013, p.42). Divergent thinking requires the brain to analyze information and access options, activating more cerebral networks than a closed ended question. This was determined by an Jauk, Benedek and Neubauer when they performed several electroencephalography studies, measuring brain waves during convergent and divergent tasks (2012). In their study they noted higher brain waves were detected when subjects were engaged in divergent tasks, suggesting divergent tasks are more challenging and the responds by recruiting more neurons to devise a plan for accomplishing the

new task. The new neural pathways increase the brain's ability to find new patterns and manage complex problems. Imaging studies of the brain confirm individuals with more neural pathways present have greater creative capacity than individuals with fewer neural pathways present. (44).

Providing students with divergent thinking tasks challenges the brain to develop new pathways and it changes the brain. A 1995 study by Schlaug, Jancke, Huang, Saiger & Steinmetz of 30 musicians through brain imaging found the corpus callosum was significantly larger than those of non-musicians of a matched group. This finding caused researchers to question did the enlarged corpus callosum result from the musical training or was the musical training the catalyst for the enlargement. Maguire's study in 2000, also of brain imaging, focused on London cab drivers. Scientists focused on the hippocampus, part of the brain responsible for facilitating spatial navigation and memory. The hippocampi of the taxi drivers were significantly larger than those of the control group, and the size correlated with years of experience as a taxi driver: the longer his career the larger the volume of the hippocampus, evidence the brain can alter to respond to environmental demands (as cited in Sousa & Pilecki, 2013, p. 45). Both these studies suggest the brain is affected both structurally and in capacity when provided tasks which necesitate creative thinking. Why, then, are teachers not using open ended tasks that require student problem solving to enhance and grow the brain structures of children?

Teaching with the Brain in Mind states humans learn in many ways, through sensitization, habituation, imitation, semantic learning, and by doing (Jensen, 2005, p.16).

Co-teaching. Co-teaching, first described in the 1970s, was designed to reach students with disabilities. More commonly used in the 1980's, two teachers of equal professional status, usually a classroom teacher and a special education teacher share instructional responsibility for a group of students. With shared responsibility also comes difficulty in navigating ownership.

One teacher may not feel as comfortable with the content, a teacher might not share their students readily feeling ownership based on the pressures of high stakes testing and accountability. Common planning between the two teachers can also be another obstacle to co-teaching without fear. In her article *The co-teaching Partnership*, Marilyn Friend, outlines helpful parameters to govern a co-teaching partnership to garner success. First and foremost, the "co-teaching should be a part of the school culture that encourages professionals to work together" (Barth, 2006). In addition to the shared vision of working together, co-teachers need the opportunity to receive professional development and time to prepare for their roles as co-teachers. In this time of planning and preparation, they establish unified expectations for students and for one another's roles as teacher leaders within the classroom. Co-teachers can benefit from visiting classrooms with similar co-teaching structures. "The strength of co-teaching comes from the many opportunities to use innovative practices that would be far less practical in a classroom with just one teacher." (Friend, 2007)

Professional Learning Communities. Confucius observed, "I hear and I forget. I see and I remember. I do and I understand." We learn best by doing. DuFour (2010) states most educators' deepest insights and understanding come from action, followed by reflection, and the search for improvement. We know students learn best from authentic experiential learning so we can generalize that adults would garner their best learning through hands on reflective practice followed by action. DuFour proposes Professional Learning Communities or PLCs as the answer for creating intentional educators "working collaboratively in recurring cycles of collective inquiry and action research to achieve better results for the students they serve." Much like Friend's model of co-teaching, DuFour's PLCs is composed of collaborative teams who work interdependently to achieve common goals. These goals are defined and are attained by the

collaborative effort of teachers to answer these four questions: 1) What knowledge and skill should every student acquire as a result of this unit of instruction? 2) How will we know when each student has acquired the essential knowledge and skills? 3)How will we respond when students do not learn? 4) How will we extend and enrich the learning for students who are already proficient?

The question may be asked: Why is it important to organize a staff into collaborative teams? "The very reason any organization is established is to bring people together in an organized way to achieve a collective purpose that cannot be accomplished by working alone (DuFour, DuFour, Eaker & Many, 2010, p.139). The DuFour model of collaborative practice can lead to programmatic sustainability by developing increased participant capacity, harnessing the power of peer pressure, finding strength in numbers and demanding accountability, all of which create structures of support (DuFour et. al, 2010, p. 235).

Benefits of STEAM. "STEAM is a way to take the benefits of STEM and complete the package by integrating STEAM principles in and through the arts" (Riley, 2014). STEM alone is disjointed and lacks the cohesion provided by the arts. STEAM is the vehicle to engage learners and create critical thinking 21st Century learners is the premise of the following study. "STEAM takes STEM to the next level: it allows students to connect their learning in these critical areas together with the arts practices, elements, design principles and standards to provide the whole pallet of learning" (Riley, 2014). STEAM takes the critical components of how and what and laces them with the why.

The schools forging ahead with STEAM education are embracing a growth mindset (Maslyk, 2016). Defined as the power of believing you can improve, a growth mindset, in the

face of STEAM implementation is the "can-do attitude needed to be present as we adjust our practice and integrate creativity into our classrooms" (Maslyk, 2016, p. 13).

Barriers to STEAM. Barriers exist which prevent districts from forging ahead with STEAM programs, resistance to the approach comes predominantly from ongoing accountability pressures facing schools. While our brain has developed elaborate neural networks to process both language and music as forms of communication the pressure to improve reading and mathematics achievement is prompting elementary schools to trade art instruction for classroom time preparing for high-stakes testing (Sousa & Pilecki, 2013). When the brain is at its most adept stage of development for refining the skills needed to develop artistic talent, elementary schools are focusing on teaching test-taking skills rather than problem solving skills (Sousa & Pilecki, 2013). Barriers to STEAM in elementary classrooms are shockingly like those in secondary classrooms, time, teacher capacity, and the focus of school accountability. STEAM education is not a prevalent practice in K-12 schools. In order to accomplish the goals of STEAM schools must consider a variety of factors. Collaborative planning, schedule adjustment, professional development, time for alignment of standards and creation of assessments are just a few barriers schools face (Riley, 2014). A focus on testing has created tunnel vision for educators. Tests now serve a function similar to money, they are both a measuring tool and a means to control (Turner, 2015). Arts based learning is not easily quantifiable and therefore is often disputed as irrelevant in schools, likewise teacher education preparation programs do not adequately build teacher capacity or competence in the area of arts instruction resulting in teachers who are ill prepared or confident in using art as an avenue to engage or instruct learners (Turner, 2015). As a result of a narrow focus on testing and lack of teacher know how, allocating time and funding for relevant arts integration is not a common practice.

Schools fortunate enough to have funding for STEAM resources, do not always have a willing staff, adequate scheduling of time with resources, or clearly defined teacher roles. These obstacles can become opportunities for administrators to build teacher capacity and competence. Change in teacher practice also comes with anxiety and challenge mixed with uncertainty (Maslyk, 2016). While many benefits of integrating the arts into current STEM curriculum exist, tragically the obstacles often halt the integration before it begins. Nixon (2013) states three challenges to arts integration are time, necessary teacher collaboration, and bias of one subject to another based on teacher capacity. Time is an obstacle many teachers face when attempting to implement integrated lessons. In addition to the limited time teachers have for instruction, often their planning times differ from colleagues who might have new information to share or expertise from which to grow. This means that, within their current paradigm, the only available time to collaborate is after the school day ends. Integrated lessons need to explore content objectives in several subject areas and provide time to collaborate with teacher specialists or administrative support. Teachers tend to focus on the subjects they feel most confident teaching (Nixon, 2013).

Summary of the Literature Review

Historically, arts education has been reserved for gifted and talented students in public schools or for the purpose of enrichment. While research supports the benefit to students of instruction with arts integration, districts are still hesitant to fund certified teachers in areas which are not tested subject areas or directly tied to a school's accountability. While studies are focusing on the benefit of divergent thinking, the increase of critical thinking skills, and problem solving skills for careers yet to be created, district teachers and staff are predominantly teaching subjects in isolation and are focusing on reading and mathematics. While public interest has

highlighted the promotion of STEM in K-12 school, predominantly STEM funding has been reserved for undergraduate students. STEM alone is disjointed and lacks the cohesion provided by the arts. STEAM is the vehicle to engage learners and create critical thinking 21st Century learners is the premise of the following study. There are limited studies to determine how the implementation of STEAM is best achieved in an elementary school. The following chapter will set forth necessary steps and procedures to successfully implement the qualitative components of this study.

CHAPTER III

METHODOLOGY

Introduction

Chapter III describes a study designed to consider how to create space for STEAM education in an elementary school setting. A multiple case study was chosen to seek out how the implementation of STEAM practices impact the experience of the teachers. The following sections include the design of the research study, purpose of the research, research questions, site demographics, research subjects, and data collection measures. The chapter concludes with the interview protocol, as well as the limitations of the study.

Research Design

Qualitative research empowers individuals to share their stories, to provide a detailed understanding of an issue, established by talking directly with people, going to their place of work, and allowing them to respond with no expectation or preconceived idea of what they will say (Creswell, 2013). Qualitative research has a number of basic principles outlined by Creswell; it must take place in a natural setting, the researcher is the key instrument, data is collected from multiple sources, data is analyzed inductively and deductively, participants have meaning, it has an emergent design, it is reflexive in nature, and the final hallmark of qualitative research is it intends to create a holistic account of the phenomenon under study (2013).

Multiple Case Design

A case study investigates a contemporary phenomenon in depth and within its real-world context (Yin, 2018). Yin has established a twofold definition of case study, which speaks to both

scope and features. This study encompasses multiple data sources and is reported in a logical manner with clearly bounded cases analyzed for common themes. A case must first be defined and then bound (Yin, 2018, p. 28). Viewing the case as a bounded object rather than a process creates the idea of the case as a "specific, functioning thing" (Stake, 1995; Yazan, 2015). This study includes seven cases comprised of one STEM teacher and six classroom teachers. Case study researchers ask "how" and "why" questions to identify interest (Yin, 2018, p. 27). The purpose of this multiple case study is to gather a range of information about each case (Patton, 2002). One of the strengths of qualitative analysis is looking at a program holistically not just the singular program or person, but rather a group (Patton, 2002). This study will look at co-teaching to observe how they experienced STEAM as co-teachers and as colleagues.

Purpose of the research.

The purpose of the qualitative research study is to explore the implementation of STEAM curriculum in a rural elementary school, examining teacher pedagogical practices, evaluating the curriculum influences on teacher development, teacher motivation and outcomes. It seeks to provide a thick description of elementary teachers who share the burden of implementing STEAM practices in a rural elementary school, identifying their thoughts, feelings, and perceptions of using arts integrative practices in their classroom. The study incorporates interviews, observations, reflective journals, and student work samples to gather enough information to fully develop and describe the lived experience (Creswell, 2013, p.89).

Research questions.

Central to the purpose of this study is seeking to describe the experiences of elementary teachers implementing STEAM curriculum in a rural elementary school. The following research questions guided this dissertation study:

1. What does creating space for STEAM look like in an elementary school?
2. How do teachers describe their experience of learning to teach with and through STEAM?
3. How do teachers' perceptions and experiences help to understand the potential contributions of the arts?

Research site.

For the purpose of this study Learning Elementary School (pseudonym) is the research site, a rural elementary school in a North Mississippi district with 370 employees and 2,882 students in grades pre-k through twelve. As a whole, the district has an above average record in student achievement. The district is the smaller, more rural, of two districts in the county. The district consists of four schools qualifying for Title I funds based on the percentage of students receiving a free and reduced lunch rate, Learning Elementary School being one of them with a free and reduced lunch rate of fifty-six percent. Learning Elementary houses grades Pre-K through second grade with 49.2% male and 50.8% female with an ethnic makeup of 17.0% African American, 80.1% Caucasian, 1.7% Hispanic and 1.2% Other. This school population is representative of the district.

Research Participants

This study uses a purposeful sampling approach in order to use participants who could best respond to the larger questions of the research about teacher practice and perception. The specific sample of selected individuals allows for participants who could give detailed description of their lived experience and enough data in interviews to create a strong sense of the process among skilled and tenured teachers.

The determination of eligibility for this study require all participants to have three or more years of instructional experience. In order to address the research questions one teacher chosen will be the school's STEM teacher, six classroom teachers will be chosen, two from each grade level, kindergarten, first, and second grade. Special consideration was given to eliminate participants related to the researcher. The number of years of experience is taken in to consideration to eliminate the concern of classroom management or student behaviors being a concern for the implementation of the STEAM lessons within the general education classroom.

Data Sources

Multiple sources were used to create a triangulation of evidence (Yazan, 2015). Triangulation strengthens a study by combining methods (Patton, 2002). For this study, observations, field notes, and interviews were used. After each lesson teachers wrote reflections in journals to help provide insight to their experience and drive planning for the next lesson.

Observations. One type of qualitative data used was observations by the researcher. The researcher observed within the six classrooms taking field notes as the STEAM lessons were occuring. These field notes provide prompt feedback, insight, and provide a general impression (Creswell, 2013).

Interviews. Interviews were used to gain information of the seven participating teachers prior to the onset of the study and at the completion of the study. The interviews helped gain perspective and gather the lived stories of how teachers in a rural elementary school create a space for STEAM. "We cannot observe how people have organized the world and the meanings they attach to what goes on in the world. The purpose of interviewing, then, is to allow us to enter into the other person's perspective" (Patton, 2002, p. 341). The interviews took place in two phases. In both phases of interviews the researcher asked questions from a standardized

open-ended interview protocol; all interviewees were asked the same basic questions in the same order, and all questions were worded in a completely open-ended format. The interview instrument was chosen to increase the comparability of responses and to reduce interviewer effects and bias (Patton, 2016). Phase I of the interviews occurred at the onset of the second term prior to the start of the STEAM instruction. Phase I questions begin with an icebreaker to gather background information about each teacher. Following the icebreaker, teachers were asked basic knowledge questions to provide the researcher a basis for how the interviewee understands arts integration, STEM, and Professional Learning Communities. The interview closed with a question allowing the interviewee to comment or make a statement to the researcher about anything she thought should have been asked or addressed. The second phase of interviews occurred at the end of the study, at the end of Term 2. Phase II interviews begin with an icebreaker question which will allow the teacher to describe what the room would look like during a STEAM lesson. The questions following the icebreaker allow the teacher more opportunity to describe comfort level at the close of the study with implementing arts integration, STEM and STEAM practices. Interviewees will have the opportunity to discuss the impact of Professional Learning Communities had during the study, as well as, to describe their vision for STEAM Sustainability within their school. Phase II interviews close with the opportunity for interviewees to bring to light any questions or thoughts they wanted to discuss, but were not asked. Phase I and Phase II of the interviews used questions which were peer reviewed and field tested in prior studies. (Tillman, 2018; Wilson, 2018)

Reflective journals. Throughout the study teachers kept reflective journals and participated in professional learning communities. The researcher met with the teachers during these planning sessions and took field notes to provide the researcher descriptive information of

how teachers describe, experience, navigate and make sense of their own processes of learning to teach with and through STEAM. Observations of staff interactions and decision-making processes provide opportunities for evaluators to note what did not happen (Patton, 2002). The field notes helped to add description to the multi case study.

Using a variety of data sources, the researcher was able to validate and cross check findings. Patton asserts that each type of data source has strengths and weaknesses and combinations of sources help increase the study validity (2002, p. 306).

Table 1

Timeline for Qualitative Data Collection

Data Source	Data Collection	Data Evaluation
Teacher Interviews Phase I	Onset of Term 2	Onset of Term 2
STEAM Professional Development	Onset of Term 2	Onset of Term 2
Professional Learning Community	Onset of Term 2 After each Participant completed Lesson 1	After each Participant completed Lesson 1
Teacher Observation	During each scheduled lesson	During each scheduled lesson
Teacher Interviews Phase II	End of Term 2	End of Term 2

	Teacher Reflective Bimonthly Journals throughout Term 2	End of Term 2

Timeline.

One elementary STEM teacher sees every class once a week for thirty minutes. At the onset of the second nine weeks the STEM teacher will enter the six teachers' classrooms during the morning reading block to co-teach STEAM lessons with the general education teachers. Two teachers from each grade level met with the STEM teacher to plan, collaborate, and brainstorm how to best implement the lesson for their class in a Professional Learning Community as defined by DuFour (2010). Initially the researcher met with the seven participating teachers to interview participants individually.

Resources.

Resources will initially include the administrator of the site, who has overseen the planning of time and teachers to use in this study. Next, the teachers, the one STEM teacher and the six classroom teachers, will act as primary resources. Teachers involved in this study will participate in Phase I interviews prior to an informational STEAM professional development led by the researcher. The professional development developed by Susan Riley with *Education Closet*, is a web-based program consisting of videos and teacher planning documents. Teachers will participate in the planning of their lessons and will then carry out their lesson co-teaching them with the STEM teacher.

Methods of data analyses.

A six-step approach for analyzing qualitative data, outlined by Creswell (2013) will be used for this study. The steps include: (a) organizing and preparing the data; (b) reading the data for meaning; (c) coding the data; (d) developing descriptions, categories, and themes; (e)

determining the method of reporting and reporting the findings; (f) interpreting the data. The researcher transcribed and coded each interview session which was audiotaped with verbal permission of the interviewee. The transcribed interviews were read and unitized by the researcher. Unitizing as defined by Lincoln and Guba is the smallest part of information about something that can stand-alone (Stapp & Wolff, 2017). This facilitated analysis and aided in identifying common themes within the interview transcriptions and organized data into a sizeable chunk; each chunk will be bracketed and identified as a unit and coded. The units identified were charted in a spreadsheet to bring emerging themes to light for "constant comparison" (Lincoln & Guba, 1985). Common themes in discrepant information were written in the final narrative summarizing the data from the interviews. Through the aforementioned process, the researcher was able to recant the lived experience of teachers creating a space for steam.

Limitations to the Study:

Existing literature lacks specificity of what STEAM is beyond STEM with the arts, which is a limitation of this study. The small sample size is a limitation in this study. With seven perspectives it is impossible to gain all insight needed to fully define and describe the lived experiences of creating a space for STEAM education. Using a combination of data collection, the researcher hopes to lessen the limitations to the study. Observations taking place in the classrooms of the teaching participants are subject to limitations. Researcher bias for sharing the lived experience with the classroom teachers in professional development might also identify as a limitation. Interview limitations include potential distortion of responses due to personal bias, teacher attitude at the time of interview, and the pressure of performance being interviewed by a supervisor. As identified by Patton, using a variety of sources and multiple approaches the researcher hopes to minimize the weakness present with single approach collection and create

strength through triangulated methods (Patton, 2002). As this study spans from October through December, the short timespan might also be identified as a limitation to this study. From the initial interview until the final interview, nine weeks might not allow participants to fully grasp meaningful insights to creating and utilizing the most influential STEAM practices (Patton, 2002).

Conclusion

The previously mentioned methodology has provided what Creswell (2011) calls a blueprint for the proposed research study. These methods offer a guide for the researcher and others to successfully implement the study. The research procedures in this study include a general overview, site demographics, and participant selection procedures. The design of this study is a multiple case study. The researcher will gather data through two phases of interviews, reflective journals, field notes taken during observations and professional learning communities. The critical friend will be used to triangulate the data through data discussions. The critical friend will provide feedback to validate and provide trustworthiness within the study. The purpose was to investigate the lived experience of teachers and what it looks like to create a space for STEAM in a rural North Mississippi elementary school.

CHAPTER 4

INTRODUCTION

Chapter IV provides the results for the study, "Creating a Space for STEAM." The purpose of this study is to explore the implementation of STEAM curriculum in a rural elementary school, examine teacher pedagogical practices, evaluate the curriculum influences on teacher development, teacher motivation, and teacher results of common planning. The study incorporated interviews, observations, reflective journals, audio recordings of planning sessions, and student work samples to gather enough information to fully develop and describe the lived experience. To begin this multiple case study analysis, it is important to understand the multiple cases which make up the larger context in which they are situated. For the purpose of this study a case is defined as an individual participant. Each of the seven cases, who are participants in this study, will be introduced. Following the introductions, the codes will be defined. Each research question will be addressed and connected to the codes, and the results will be discussed, including the similarities and differences across the cases and the themes that emerged during the implementation of STEAM.

Data analysis began with the first phase of interviews with the participants. Field notes, observations and written reflections were used to support findings. The central purpose of this study is describing the experiences of elementary teachers implementing STEAM curriculum in a rural elementary school. The questions that guided the research were:

1. What does creating space for STEAM look like in an elementary school?
2. How do teachers describe their experience of learning to teach with and through STEAM?

3. How do teachers' perceptions and experiences help to understand the potential contributions of the arts?

As I sought to answer these questions, three categories arose as elements of influence and were common to the participants, comfort, capacity, and constraints. Within the first category of comfort, two smaller categories arose, familiarity and content. Within the second category of confidence, one smaller themes emerged, capacity. And within the third category of constraints two smaller themes emerged, resources and lack of knowledge. Each of these themes will be discussed further in the following sections.

The Cases- Seven Teachers

Table 2

Descriptions of the Cases - Seven Teachers

Teacher Participant	Age	Years Teaching	Road to Learning Elementary School	Definition of Arts integration
Leslie	30	8	-30 miles from her high school institution -taught in another district for three years -moved to district to be closer to home	"We include it in our classroom. Whatever curriculum we're talking about, or whatever topic…"
Molly	29	8	-graduated from district -Student taught in district -only taught at LES	"I guess just bringing it into centers pulling it in with books and art...different things like that."
Becky	27	5	-student taught at LES -hired as a certified teacher the following year	"What we might do is create a bat sort of like a craft but they might label their bat once they create it."
Darla	45	21	-Graduated from district -student taught at LES -only taught at LES	"Integrating arts in everything you do."
Rana	30	7	-30 miles from her high	"...providing an educational

			school institution -Student taught -Stayed after student teaching	background and everything should be structured around something that they can learn from...versus just something to waste time."
Haylee	35	8	-completed observation hours in district -taught in a neighboring county school -came to district to work where her children attended	"Using art like not teaching it in isolation, teaching it with…"
Kala	31	9	-worked in a Mississippi Delta School -took an assistant position for a year to gain a certified position in district	"Whenever you find ways to integrate it into math and language. Whenever it's a tie in."

Leslie

Leslie is a 29-year-old Kindergarten teacher in her eighth year of teaching. This is her fifth year at Learning Elementary School and prior to her current school placement she taught first grade at an urban district. She identifies herself as not very creative and she defined arts integration as including art into current curriculum saying, "we just do technology, we do music, we do drawing, painting those types of things, and we read books about the certain things we're talking about." While she tries to implement art at least two times a week, she admitted she did not want to do the same type of art week after week, and lacked knowledge of how to plan other integrations. Her knowledge of STEM is limited to the recently implemented STEM lab at Learning Elementary School and while her students love it, the greatest take away is the support she receives from the STEM teacher in the form of emails each week including her weekly plan for the lab and options for classroom teachers to implement supporting lesson within their rooms.

An active member of professional learning communities within her grade level, she said she felt supported by her colleagues and the community that formed out of being able to share

what she and her colleagues are planning in each of their rooms. The community develops out of being able to vent first then talk about ways to improve what they each are doing.

Molly

Molly is a teacher, 29 years old, a graduate of Learning School District and who has taught her entire career of eight years at Learning Elementary School. A kindergarten teacher for the last six years, she taught pre-k for one year and first grade for one year. She defined arts integration as bringing art into centers she plans for her students with books. She tries to integrate art once a week, but stated the curriculum now, leaves her with so much to cover during the day time is a barrier. Her knowledge of STEM education is limited to the acronym and when she attempted to discuss she left out engineering as a piece of the initiative. When asked to discuss the impact of the STEM lab on her students she was unable to narrow the impact to one student but summed up the class by saying, they love it, and are eager to go back the next week. Molly's take away from professional learning communities she currently is a part of is the reciprocal idea sharing with her colleagues. She reported she feels supported and is able to see what they are doing in classrooms and share what is happening in her classroom.

Becky

Becky is in her fifth year of teaching at Learning Elementary School, which is where she student taught while finishing her degree. She was hired as an assistant teacher for one year and has held her own classroom for four years in first grade. When asked how she would define arts integration she questioned the use of fine arts, and then began to describing a scenario where who students had created a bat craft earlier in the week. She identified herself as comfortable when teaching an arts-based project, but cited knowing math, writing, and reading are so important, she overlooks art, focusing on key areas they (her students) really need to be successful. Her prior knowledge of STEM was limited and guessed that it meant more

experiment-based learning for students. Becky was quick to celebrate the STEM lab teacher, and her willingness to share her lessons and support her instruction. She spoke of being relieved to have guidance in science instruction saying, "I'm gonna be honest. I really don't get into science very much." Her most valuable take away from participating in PLCs is "bouncing ideas off one another."

Darla

Darla is in her twenty first year of teaching at Learning Elementary School. She was a graduate of this district and after finishing her degree from a local university she obtained a teaching job with the district and never moved. With the exception of three years when she taught a multilevel Kindergarten/first grade class she has taught only first grade. Her interpretation of arts integration is "integrating arts in everything you do." She attempts to have an art experience for her students each week. When discussing the STEM lab she mentioned, "...it gives student focus on science that we don't have time to do." Darla enjoys her time spent in PLC and cited having a small group to exchange ideas with helped her feel supported, and she was very comfortable when meeting with her colleagues, sharing ideas, explaining how they will attack the next lesson or planning the lessons and common assessments. Darla is a leader among her peers.

Rana

Rana is 30 years old. She is from the area, attending high school thirty miles from the district, she student taught at Learning Elementary School and was hired after completion. She teachers second grade and has been with the district seven years. Her definition of arts

integration, “providing an educational background and having everything structured around something they can learn from.” She attempts to utilize art once every two weeks but cited with current curriculum it is difficult to fit it in. As a teacher she feels comfortable implementing art activities, and credits her year as a Kindergarten teacher as a contributing factor to her comfort. When asked about the addition of the STEM lab to the school, she excitedly told of how her students were engaged each week and as a teacher she felt supported saying, “it picks up where I lack because of time.” She attributed the success of professional learning communities within her school to the collaboration that takes place each week.

Haylee

Haylee is the most senior in age of the participants, at 35 she is the most recent addition to the staff at Learning Elementary School in comparison to her colleagues which participated in this study. Prior to her hiring she obtained a degree in political science and international studies before pursuing an elementary education degree. While working in another district she worked toward and received her masters degree. Once her personal children reached school age, she applied to Learning Elementary School so she could work in the district her children attended. Prior to teaching second grade at LES she taught third grade for six years. Haylee described arts integration as, “using art rather than teaching it in isolation, teaching with it.” Admittedly she only teaches “real art” once a nine weeks because it is not tested.

Haylee was very comfortable teaching art, STEM, and even the thought of integrating arts into STEM instruction. She was encouraged by the induction of a STEM lab to the students’ weekly rotations. “It’s neat that we don’t have to teach all of those standards, so we can bring things out they've learned from a teacher who’s planned a really thorough and amazing

lesson." Adding to the collaboration with the STEM teacher, she discussed the different perspectives as a strength to PLCs with her colleagues.

Kala

Kala is 31 years old and in her tenth year as a teacher. She now teaches pre kindergarten through second grade students STEM. She meets with each class in the school one a week each week in her lab and then once each nine weeks she provides an additional lesson with each class in their classroom. Prior to teaching STEM she taught fifth grade for two years in a critical needs area school, she came to LES her third year of teaching as a learning assistant in Kindergarten for a year before gaining a certified position teaching Kindergarten, second grade and then first grade for three years before being named the school's STEM teacher. When asked to give her definition of arts integration she replied, "Whenever you find ways to integrate it into math and language. Whenever it's a tie in." She added to this idea when she discussed her definition of STEM saying, "STEM allows for hands on learning activities that enrich math and science and help develop problem solving skills and collaborative abilities."

Kala is enthusiastic when she describes her new position as the school's STEM teacher. She enjoys teaching the students perseverance through the weekly challenges.

> One student, was frustrated last week with a challenge and said it was hard. I told him yes, it is hard. That's why it's called a challenge but I will never give you something that you can't do, if you try...and they did it.

Kala is learning the subtleties of her new role in the research site. She is learning how to best support teachers and how to meet the needs of each student at the school level rather than the classroom level, she focuses on teaching students perseverance and the importance of failure to find success, "it (perseverance) feeds into everything else."

She, like other participants, contributed time as a constraint for not planning STEM lessons in past school years. Participating in PLC has been an added system of support for her instruction. She finished her interview saying, "two heads are better than one."

These cases are representative of those leading many classrooms in rural elementary schools. These teachers are in the beginning to middle of their careers with ages ranging from late thirties to mid-forties. They have yet to start families or are raising school age children. These teachers are at home. These cases were agreeable in participating. They feel supported in their school and feel they know the content and how to garner ideas from one another.

Elements of Influence

From the analysis of the data collected during interviews, through observations, and from written reflections various elements arose that influenced the teachers' experiences. The idea of comfort, confidence, and constraints emerged as common themes among participants as they described and reflected on their lived experience of implementing STEAM.

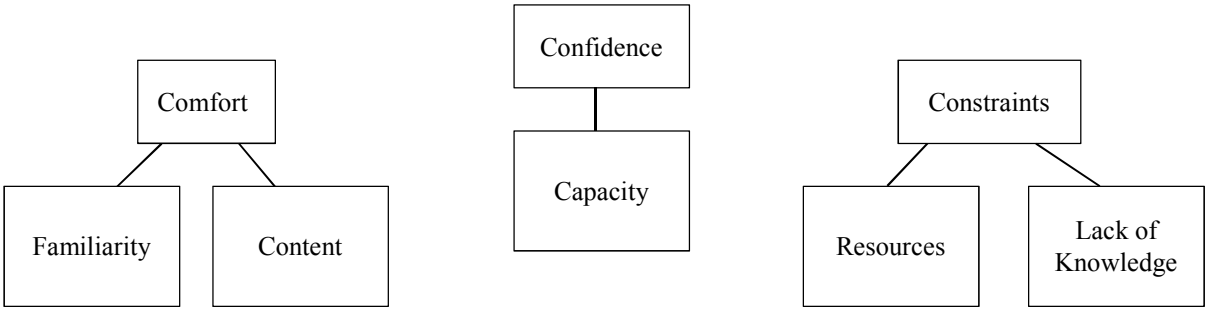

Figure 1. **Elements of Influence**

Comfort

Comfort is defined in this coding scheme as any factor that the teacher identified of which the teacher had prior knowledge of and aided in the implementation of STEAM. This element contributed to the participant feeling at ease or competent in their relationships, skills,

and resources. These elements have occurred over time prior to the onset of this study, familiarity with the research site encompassing both colleagues and the school and content of the instruction.

Familiarity. Familiarity is defined as familiarity with the school which is defined as the research site, familiarity with colleagues, both their in-room support staff and also other research participants, and familiarity with professional learning communities. All but one of the participants have worked at the research site with one another a minimum of five years with one participant working at the site three years.

The research site, a rural school district, was home to two of the participants, they attended elementary school at the school and graduated from the district. Both of the participants student taught in the district and obtained their initial teaching placements in the school and have remained at the site for the entirety of their teaching careers. The other five participants were not products of the district, but graduated from high schools within a 75-mile radius. Two of these five, Rana and Becky, student taught at Learning Elementary School, while earning their degree from a local university and were hired after completing student teaching as classified staff for a year, before being hired for a certified position. The three remaining participants taught in nearby districts, for 2-3 years before seeking employment with Learning Elementary to Leslie said "be closer to home" or like Haylee "teach where my children would be in school."

Each participant has at least three years of working with each other at the building level. During those common three years they have a shared experience working with the same administrators both at the building level and the district level. The each grade level pair of participants have worked a minimum of three years together as grade level colleagues and have participated in professional learning communities and weekly grade level meetings together for

those three years. In addition to the grade level teachers the STEM teacher participant has worked in the grade levels of each teacher as a teacher and has participated in professional development alongside each participant.

Since the fall of 2011, Learning Elementary School has participated in Professional Learning Communities. Time was set aside during the school day each week for teachers to come together for 30-60 minutes of focused and intentional professional development. These professional learning communities have ranged from homogeneous to heterogeneous grade level groupings with various support staff rotating in and out of the meetings. These weekly planning times have revolved around four questions: What do we want our students to know? How are we going to know if they have learned? What will we do when they do learn? What will they do when they do not learn? The common practice is a part of the school culture at Learning Elementary School and teachers are comfortable with the structure and function of professional learning communities.

Content. Three interview questions framed the findings for this portion. Participants were asked how comfortable they were implementing art into their instruction; how comfortable they were conducting a STEM lesson with students and how comfortable they were implementing STEAM. At Phase Two of interviews the participants were asked their level of comfort for implementing arts instruction, STEM, and STEAM into their lessons and of the seven all gave affirmations they were comfortable in their ability to implement arts integrated instruction. Six out of seven participants were very comfortable in their ability to integrate STEM lessons into their daily instructions. Five out of seven participants identified themselves as confident to be able to continue implementing STEAM lessons. Those participants who were not very comfortable identified as moderately comfortable sighting a slight level of discomfort in

lesson implementation due to a need for more study and greater preparation time. Teachers answered these questions based on their ability to carry these implementations out themselves not in the context of continued co-teaching, as performed in the research study.

Confidence

Confidence arose from the research questions that directly asked participants if they were confident in their ability to carry out instruction which integrated the arts, STEM skills or STEAM practices. Each of them spoke of being readily able even comfortable to carry out the needed planning, collaborations and coteaching to provide students with learning opportunities, but when observed in professional learning communities and in the classroom during the lesson observations it was evident teachers were less confident. One participant even noticed her own lack of confidence when she said, "I don't think co-teaching would be something I would enjoy, self-realized control freak here!"

Capacity. Capacity in this coding scheme refers to the perceived abilities or skills needed for participants in this study to carry out the task of implementing STEAM at the research site. Participant capacity was viewed through the lens of capacity in working with colleagues through planning and co-teaching, capacity in knowledge of content, and capacity of participants' efficacy and growth mindset.

Each participant was asked to work together taking part in a professional learning community and co-teaching. Participants were familiar with each other based on years of work experience together. Participants were familiar with the structure of professional learning communities and the expectations for participation within the professional learning communities. Each participant has worked with classroom assistants and thus has worked alongside another teacher when carrying out instruction within her classroom. If capacity in this

study is defined as the perceived skill or ability to carry out the task, then it is evident participants embody the capacity to work alongside colleagues planning and co-teaching.

Participants at the onset of this study were admittedly comfortable working with one another. It is common practice teachers at Learning Elementary School to work each day with learning assistants and with team teachers, or teachers that share a common wall between classrooms who historically partner together to plan and execute lessons with their joined classes. After the completion of each lesson teachers were asked to reflect on a lesson low and a lesson high and were asked to reflect and describe their experience co-teaching during the lesson. A lesson high was explained to the teachers as a moment identified when students were particularly receptive. A lesson low was defined as a moment when students needed greater assistance or when the teacher saw the need for a change in practice to better extend the lesson. Five of the seven participants reflected they acted as more of a facilitator alongside the STEM teacher. Kala's experience as the STEM teacher was radically different. While each participant was able to co-teach two lessons with Kala, Kala had the opportunity to teach with six different teachers. At the conclusion of the push-in lessons her reflection on the co-teaching experiences was marked by her willingness to grow as a co-teacher. Kala reflected,

> Overall, the co-teaching has been a growth experience for me. It's not so much that relinquishing control is a problem for my ego, it's that I don't know what I'm doing this year until I do it. I did not have the self-confidence of foresight to help teachers plan ahead. Hopefully next year will be a better year for truer co-teaching.

It can be gathered from the teacher reflections more work is needed to build teacher confidence in not only work alongside one another but working with someone. Experience will provide

some confidence but to truly build teacher capacity work needs to targeted toward growing teachers to work interdependently.

Confidence in their knowledge and skill differed from their comfort in the area of content. Rana said, "I could plan it and do it. I'm just, making sure I'm doing the best that I could and I'm meeting all of those topics is what would make me nervous," Anxiety existed but is attributed to discomfort not lack of confidence. Haylee worried, "I'm concerned that arts may be satisfied by color/cut/ glue activities that we already do ad nauseum in primary grades which would erode the richness of all the arts integration could be." Her confidence was not in her own knowledge of the content but in the lack of knowledge in the depth of the standards and how to integrate art rather than plan for a craft.

Efficacy is defined by teachers believing in their own ability to guide students to success. This idea of efficacy emerging alongside teacher confidence came from the belief that a teacher lacking in confidence is less likely to push students, try new methods, or push through difficulty. Participants were asked to identify students who benefitted from the STEM lab or the STEAM lessons, reflecting on the reason for success. Rana told of a student,

> I had a student who is very, very shy and she doesn't want to share any of her work. She sounds like a mouse, but she loves what they do in lab so much, and she builds it. If she does something like a poster they made she presents it to the whole class and that is one of the only things that I can really get her to be loud about. She loves it and she love the group aspect of it she loves building it.

Likewise, Haylee discussed, "This year it seems to be, I have a couple of boys...who are very kinesthetic, and they like to move around and do stuff with their hands. I think they're getting a lot."

In terms of teacher efficacy as sub theme of capacity a shift must occur in thinking. Participants must move past their level of comfort, they must move past familiarity and must believe in their ability to carry out a successful STEAM implementation. A level of confidence is needed, but adding to confidence, to move from a present mindset to a future mindset a growth mentality must be present to garner participant engagement and willingness.

Growth mindset came to light when participants were asked how their experiences in this study could be enhanced, by reflecting on the challenges of implementation and providing recommendations for program sustainability. Molly said,

> I think there's always opportunity to grow...If I could be more involved with sitting down and planning another lesson, I think that would be great, because two minds working together could really come up with something great.

Participants were given a program overview at the onset of the study. They were provided professional development and were given specific times to plan, but like Molly, other participants felt more time to plan with colleagues would be beneficial moving further. In a reflection following the second professional learning community Haylee wrote, "To be honest I did not think PLC today was very productive." She continued with an admission that her next lesson was not for another month so her attention was elsewhere and she was distracted. She followed up with takeaways for future meetings, "Everyone should be responsible for bringing one piece of the prep, and in the event, everyone is drained, scrap the meeting and reconvene another day." No other participant was as outspoken as Haylee, she carried a strong voice within the study. She frequently stated in her reflections that she was "self-aware" and often framed her point of view using the environmental factors of the meeting or the lesson.

A focus on student engagement came out as participants reflected on lessons. While participants described their thought processes and how they felt working with others, a natural moment in teacher practice comes from when teachers begin to search for student impact. How the participants rated lesson success was brought to the forefront when they outlined specific moments during the lessons students were engaged. The most common observation was how well students collaborated and through questioning students were able to justify their group decisions. Rana said, "One high point was the creativity that resulted from this lesson! My students created great work and showed some really great thinking and collaboration." One concern that arose from a participant was the concern of gender roles that some students assumed of themselves and their classmates. The participant did not elaborate on this point, but as an outlier it should be noted and possible addressed in future studies.

Constraints.

Constraints identified by the participants in this study were not thought of with contempt, but with acceptance. Participants were aware from the first phase of interviews of the constraints which prohibited them from planning art integrated activities. Time was a common answer when participants discussed why they did not plan more activities focused on using art. Conversely to this, many participants noted the comfort which they felt knowing while they did not have time or room in their curriculum to plan art or STEM activities, they were confident in the STEM teacher and how she was doing they work they could not wedge into their full day. Molly said,

> I think that they (students) are really benefiting from it because it's something different that I don't expose them to in the classroom even though it's skills that they have been exposed to in the classroom they're just digging a little deeper in the STEM lab because I don't have time for it.

Resources. Resources in this study are defined as anything that would hinder or support the carrying out of instruction. This includes but is not limited to, people, time, and materials. A constraint spoken of by several participants dealt with building level administration and the priority the administration places on the common curriculum among the building. Haylee said, "It's frowned upon if you...get off the curriculum. You know, we've got to teach the curriculum with fidelity." She followed up saying, "we are 'scared' to get caught not teaching tested information." While other participants mentioned in a sidebar manner they felt tied to the current curriculum, Haylee was the rebellious participant who did not let fear keep her from being honest saying, "I'm very comfortable with teaching STEAM, as long as no one comes in to observe me." Like the other study participants, she was sure of her capacity to teach and aware of administrative priorities, she was the only participant vocal about the constraint of administrative pressures and their direct effect on her teaching evaluations.

Molly, like many of the participants, felt a need for materials. She stated, time was a challenge which needs to be addressed, "Time, I think finding the time to do anything really is the issue in my classroom." Rana added a concern which echoed the issue or time as a resources saying, "..my concern is how do you meet, and assign your standards to a STEAM topic…how do they solely STEAM? How do they fit it all in?"

Lack of Knowledge. Lack of knowledge refers to what participants admittedly do not know about STEAM implementation, including co-teaching and integration. The lack of knowledge does not stem from any one place of unpreparedness, rather is a culmination of several contributing factors. Schools of education have not provided classes or courses to provide the preservice teachers knowledge in STEM or STEAM. Participants were provided the majority of their coursework in reading instruction with additional courses available if chosen by

the participant prior to graduation. At the research site participants are provided lesson plans and pacing guides from Kala, but not mandated to utilize lesson extensions. For the purpose of this study research participants were provided professional development which addressed the individual components and the basis of lesson integration. The online platform of professional development provided participants with video based tutorials as well as planning documents to aid in implementation of STEAM.

Research Question One

What does creating space for STEAM look like in an elementary school?

To answer this research question participants were asked during phase two of interviews to describe their classroom during STEAM instruction; what would be seen is observing in their classroom during this time.

Table 3

Descriptions of Classrooms during STEAM instruction

Teacher Participant	Teacher Response
Molly	"Fun learning aspects were brought in that we don't always get to incorporate into our daily lessons. They were actively engaged throughout. They worked extremely well with each other.
Leslie	"...students were engaged and fully into what they were learning about."
Becky	"Typically, the student are at their seats. Ms. Kala would be up at the board showing the students what they would be doing. She would explain the lesson and I would walk around and help as they need it."
Darla	"Excited children."
Rana	"I think it would be a brief introduction and group discussion, but in STEAM I think it's a lot of the children doing a lot of the work themselves and our teacher being more of a facilitator. So I think you are gonna see a lot of group work, encouraging the students to ask a lot of questions, and then you'd see the adults in the room walking around and monitoring it."
Haylee	"Kids are in groups, most of them are engaged. You can definitely tell who the leaders are, and it's interesting to see who emerges depending on the activity. They're doing something hands-on, depends on what we're doing."

Kala	"They're sitting in groups and it starts out whole instruction and they're pretty excited because they have a guest speaker who usually doesn't come into their classroom. And then we break off into one on one time or small groups, and they're usually pretty engaged because, again, it's not the norm and they like it"

While the participants' descriptions provide their take aways from the STEAM lessons they led in their classrooms, a sample lesson might help in providing a framework from which to garner deeper understanding.

Description of a STEAM Lesson

Lessons were created during co-planning and each participant had the opportunity to give insight, choose how she would participate, and decide what she would bring as resources to the lesson delivery. Below is an example of the first-grade lesson, *Functions of Parts of a Plant.* The STEM teacher and the classroom teacher studied and decided on the science standard to be taught. For the purpose of this study the STEM teacher chose to use science standards as the content standard from which to integrate all other areas. Once the standard was chosen teachers continued with a backwards design to develop a lesson. Objectives were chosen to anchor the unit and co-teachers worked together to find areas to initiate arts integration.

Students were to utilize informational text and other media to gain information and then were to describe the function of each plant part. The objectives for the unit were for students to build a model of a plant, label the model and match the function to each plant part. Given an assortment of supplies and an example, students were allowed to work in groups to complete their projects. The teachers led a review of the plant parts using the reference poster and led students through a variety activity including plant yoga and a plant song.

At the end of the lesson the STEM teacher closes the lesson with a review of what they learned. She questions the students for understanding and the classroom teacher begins lesson extension or transitions to the next activity.

Table 3 provides a description from each of the participants. The lesson description provides an outline for the flow of a lesson. While the preceding provides insight a clearer understanding is provided when the codes are considered.

Creating a space for STEAM took participants' out of their comfort level and constraints and built their confidence through a growth in their capacity. Participants admitted levels of comfort when asked to participate in the study. Participants were familiar with one another, they were familiar with the structure of professional learning communities and planning alongside each other, and they were familiar with the content areas they teach. Participants were readily able to describe the constraints that kept them from carrying out STEAM practices more often. They cited time, administrative expectations, and lack of materials as reasons for not doing more STEAM lessons with students.

As participants described their experiences carrying out the lessons, they were confident in the work the STEM teacher did, like Leslie saying, "Kala is so prepared; she made it to where the kids didn't know they took control of their learning." Participants were complimentary of her work and certain if given more time to plan with her individually they could sustain the STEAM lessons. Molly was confident in her own ability to integrate arts, "I feel pretty confident that I would be able to successfully implement an arts-based project into my instruction."

Participants were comfortable taking on a new task when asked to participate in this study. Participants were aware of the constraints prior to the onset of the study yet agreeable to participate. During phase one of interviews and observed during the lessons participants

displayed a confidence in their abilities. The facilitating behaviors were evident. Participants were willing to give class time and personal time to plan, prepare, learn, and implement. During the lesson observations, while teachers confidently worked alongside one another, there seemed to arise a lack of capacity in the area of co-teaching. Classroom teachers assumed the role of facilitators to the STEM teacher rather than co-teacher. In full transparency, creating a space for STEAM in an elementary classroom was filled with facilitating attitudes met with constraining behaviors.

Research Question Two

How do teachers describe their experience of learning to teach with and through STEAM?

As evidenced in Table 4, participants were honest in their description of teaching STEAM lessons. Their takeaway from the experience was predominately focused on their work with Kala the STEM teacher. Five of the seven participants spoke of co-teaching or named the STEM teacher in their response.

Table 4

Description of Teacher experience teaching STEAM

Teacher Participant	Teacher Response
Molly	"I think the overall impact of this went very well. I was able to learn about incorporating STEAM lessons into my everyday instruction. I think it will be very beneficial to my students if I am able to continue to find ways to do so.
Leslie	"I served as a facilitator as they completed their assignments. Kala was awesome to work with while planning, she told me what she needed from me and what I could help with."
Becky	"I enjoyed co-teaching with Kala. She always brings an energy to science that I have never possessed. I felt as though the students enjoyed it as well because they got to apply knowledge in a fun way. There were times when I felt that I could've been more prepared, but overall I think it went pretty well, especially for our first try."
Darla	"It is awesome working hand in hand with the STEM teacher. I feel that it helps the students to learn even more, having different aspects of the lesson from two different teachers."

Rana	"I am not that confident in it, but I'm also very willing to learn, anything that I would need to do to be the best for my students. The lack of my own comfortableness comes from not being trained 'cause we didn't really do this at college or anything like that."
Haylee	"I really like it. I think that Kala has some great strengths that she brought to it, and then I had some strengths and I thought we worked. I didn't expect that."
Kala	"I thought I was doing the teachers a favor by handling it all on my own. But if the ultimate goal is to change the culture of the classroom and allow for more STEAM integration in the general classroom, push-in lessons do not need to be a one-person dog and pony show. Teachers need to realize that the work is in the preparation, patience to allow students to struggle, fail, and try again, and facilitating. The students do most all of the work during the lesson."

While participants were quick to celebrate their co-teaching experience or equate co-teaching with their STEAM experience, it is interesting that during observations, and admittedly by Leslie, co-teaching was one area classroom teachers struggled. From field notes and lesson reflections it was more common for classroom teachers to act as facilitators rather than to share the teaching responsibility with the STEM teacher.

Phase one of interviews asked teachers to discuss their level of comfort being a part of professional learning communities and what they identified as the most valuable part of participating in professional learning communities. Every participant identified the greatest result of participation as the support of colleagues. This comfort in collegial support and familiarity with the expectations of collaboration contributed to the collective description of teaching STEAM experience through the lens of co-teaching.

Rana stood out as a participant very aware of her lack of confidence in teaching anything outside of the provided curriculum. She admitted she was not confident in integrating art; she was not confident adding STEM instruction. When asked about her comfort level of implementing STEAM into her instruction she said, "I'm not totally 100% confident in it, but

I've watched a lot; I've been researching it a lot." While she continued in her discussion of her research, she talked through worries of fitting all the standards into her time frame and mentioned the constraints of time, and resources. Rana was one participant who made a clear distinction between her level of comfort and willingness to participate and her confidence in her ability to successfully carry out STEAM lessons in a sustainable manner. She stated after being asked about her take away from participation, "Well, it forced me to try, which was good, but I really, really enjoyed it. My kids loved it. They talked about it for weeks after."

Participants exhibited facilitating attitudes when asked to describe their experience teaching STEAM. Participants were comfortable and complimentary of co-teaching, yet their constraining behavior observed was a lack of knowledge when co-teaching, acting as a facilitator to the STEM teacher delivering the bulk of the lesson. This evidences a need for capacity building in the area of co-teaching. Participants were comfortable working with a familiar teacher, yet displayed a lack of knowledge of how to maximize effectiveness during the delivery of the lesson.

Research Question Three

Table 5 organizes participant responses to answer the third research question. How do teachers' perceptions and experiences help to understand the potential contributions of the arts?

Table 5
Perceptions of the Potential Contribution of the Arts?

Teacher Participant	Teacher Response
Molly	"It (art) lets their creative juices flow. It interests them more than most activities we do each day."
Leslie	"They have so many opportunities to show their feelings/emotions and how they deal with things and incorporate this into their academic learning. I feel the arts can bring out so much in what they are learning and it shows them different avenues on how to learn the skills involved."

Becky	"I love to implement art whenever I can."
Darla	"I'm comfortable teaching art; I enjoy it." "The arts can expand student understanding as well as represent experiences they can't verbalize."
Rana	"They don't get enough of the arts. It's a great way to tie in."
Haylee	"I feel like we need PD on what art standards mean instead of just providing lip service. I feel like there is some understanding of the standards that maybe some could benefit from."
Kala	"Art is a form of creation. It is higher order thinking: comparing and contrasting, measurement, perspective, problem solving, development, etc. Engineers, mathematicians, and scientists create, develop, and improve upon ideas. The arts help to stimulate and strengthen the parts of the brain and the skills needed to be successful in a multitude of fields, especially research and development and STEM. It also appeals to a variety of students. Students who might be apprehensive to participate in STEM lessons might be drawn in by the arts and find enjoyment in the lessons. It gives the students a picture, movement, and/or song to help gain understanding of the materials being presented. STEM and the arts complement each other and should be incorporated."

Responses varied in scope to this question. While some participants really sought to describe a sustainable model for how arts integration might meet the needs of learners, others took the description to current practice. There was a distinct disconnect in participant espoused comfort in arts integration and their enacted practices as they were observed planning in professional learning communities and describing their practice prior to STEAM implementation, during STEAM lessons, and after lesson reflections.

Lesson observations revealed a disconnect between their facilitating attitudes and espoused practice and the constraining behaviors of enacted practice (Hannafin & Polly, 2011). To define facilitating attitudes for this study these were affirmations and assurances the participants were readily able and willing to implement STEAM. The participants reported extreme comfort when questioned in phase one interviews. This comfort was identified in their perceived abilities to integrate art into their curriculum, in their knowledge of STEM and the

introduction of a STEM lab for students and their participation in professional learning communities. Becky outlined a lesson she was using to integrate art with bats and writing, "Like this week, I'm bringing in text features with students as they label their bat." Other participants had similar experiences to discuss. While participants discuss specifics with lessons and students they each had positive comments about Kala, the STEM teacher. Leslie said, "She is so great about including us in the things she is doing, beforehand...my students love it, they talk about it when they come back." The positive speech continued to when the participants were asked to describe their experience in professional learning communities. Molly reported, "Absolutely, I feel supported by my colleagues when we meet in PLCs. Just planning and talking and getting to see what they are doing and them getting to see what I'm doing is beneficial for the children." Like Molly, all participants were at ease and sure of their answers.

After the initial phase of interviews, participants were asked to meet for a professional development to outline the study, provide a time of planning in a professional learning community and discuss their shared roles as co-teachers of STEAM. During this time six of the seven participants attended and were talkative, jovial, and willing to spend time listening and gaining information about STEAM and the study implementation. As the push in lessons began and were followed by lesson reflections the contradiction between participant espoused practices and their enacted practices arose, in other words, participants claimed comfort and ease when interviewed but their observed behaviors did not support their proclaimed level of comfort. While participants had varying definitions of arts integration, their perception of a successful STEM program, all participants identified comfort when working in professional learning communities and each saw value in a program which implemented art with STEM.

Constraining behaviors of enacted practice observed during lessons and revealed in reflections are identified as practice that did not coincide with the teacher attitude or belief revealed in either phase of interviews. Additionally, these behaviors or practices were not recognized by the participants as having occurred or having a negative effect on the implementation of STEAM. At the very most a participant mentioned they would like to be more involved in the planning with the co-teacher. New to participants was the idea of co-teaching a lesson with another certified teacher, but with time set aside to plan and assign shared tasks all participants were confident they would be able to implement the lessons and engage learners. Observations showed teachers acting as a facilitator to the STEM teacher as she led the lessons. While the STEM teacher introduced the lesson the classroom teacher and, in many lessons, but not all, a learning assistant was present, moved about the room redirecting students off task or unengaged. Interestingly as the grade level increased so did the degree to which co-teaching occurred.

During all four of the kindergarten lessons the kindergarten teachers stepped to the side while the STEM teacher led the lesson. The teachers aided in providing supplies, they helped manage classroom behaviors, but took a hands-off approach during instruction. Of the four first grade STEAM lessons only one lesson was co-taught, the remaining three were led by the STEM teacher. The outlier lesson was with Darla, the 21-year veteran to the field of teaching who brought in a PowerPoint presentation and visual aids she had created prior to the lesson after planning with the STEM teacher. Co-teaching was present during three of the four second grade lessons. Consistently Haylee co-taught both lessons with the STEM teacher. Rana, co-taught the first lesson but when lesson two began to experience trouble she shied away and allowed the STEM teacher to take over and complete the lesson. Future researchers might look at the

professional noticing of teachers in their practice as they implement new curriculum. Another insight might also come from looking at student age as it relates to teachers facilitating rather than readily co-teaching new curriculum.

CHAPTER V

DISCUSSION

The purpose of Chapter V is to synthesize, analyze and interpret the study's findings based upon the guiding research questions. A brief overview will outline the study including a discussion of the findings, limitations and methodology with recommendations for future research.

Introduction

The purpose of this study was to explore the implementation of STEAM curriculum in a rural elementary school, examining teacher pedagogical practices, evaluating the curriculum influences on teacher development, teacher motivation and the results of teachers participating in common planning. This qualitative study sought to tell the story of seven teachers, one STEM teacher and six classroom teachers as they implemented STEAM with their classroom.

The problem, which was identified as a lack of arts integration in traditional curriculum, arose from a focus of districts' monies allocated for teaching tested subject areas and classified staff only providing instruction in the arts. Learning Elementary School allocated a certified teacher unit to implement STEM instruction. This led to development of this study to integrate arts in the STEM curriculum in six elementary classrooms to describe what teacher perceptions were when creating a space for STEAM.

Interpretation of Results

The results of the study derived from qualitative data collection attempted to discover and describe the lived experience of teachers creating a space for STEAM in a rural elementary school. The results of the study identified two major elements of influence, comfort and capacity as themes. Within the theme of comfort, three smaller codes were identified, familiarity, content and constraints. Within the theme of capacity two smaller themes were identified confidence and efficacy. These themes identify areas of focus which need to be addressed in order to create a sustainable STEAM program.

According to the results all participants described themselves as comfortable with implementing arts integrated lessons, yet each had a varying definition of arts integration. All participants were comfortable working with one another, most saying they felt supported and all agreeing their greatest take away from planning together in professional learning communities was the sharing of ideas and having insight into other teachers' classrooms. In the vein of described teacher comfort, all participants reported as both aware and seemingly unfrustrated by the imposed curriculum as well as their access to resources and knowledge of administrative expectations.

The theme of capacity directly refers to participants perceived ability or skill needed to implement STEAM, confidence and efficacy emerged from questions asked in relation to participant practice. Participant confidence refers to the assuredness they felt in relation to their capacity to work with colleagues, know the content, and co-teach during STEAM instruction. Efficacy like capacity refers to participants' perceived ability but focuses on guiding student success.

While conducting lesson observations and reading participant reflections each participant declared a facilitating attitude but displayed a constraining behavior. As the study drew to a close the distinction between comfort and confidence was more evident. The facilitating attitudes of the participants during the interview phases came from a place of comfort. Participants answered questions based on past experiences and felt comfortable in their ability to recreate past structures or use learned content. Constraining behaviors were observed during the lesson observations and were reflected afterwards displaying a lack of participant confidence. The constraining behaviors of inadequate co-teaching practices, lack of knowledge of arts integration, evidenced teacher's current participation did not create a particular assuredness they could sustain implementation.

Implications of the Research

There are several implications and recommendations from the study's findings useful to stakeholders from many fields in education. These were gathered from a review of the literature, observations as a researcher, and the stories of seven elementary school teachers. It is my hope that these recommendations be used to promote arts integration in current STEM programs, or implement STEAM practices at Learning Elementary School and similar elementary classrooms.

Classroom Teachers

Classroom teachers must have a growth mindset. They must be willing to implement new strategies and embrace new curriculum. Classroom teachers need to be committed to continual refinement of their practice and with the implementation of new curriculum, need to seek out mentors, co-teachers, and experts who will initiate collaboration during the planning, instruction and reflection process. Classroom teachers need to be willing to reflect and identify

perceived levels of comfort, identify the point at which confidence is lacking and work to grow their capacity.

STEM Teachers

STEM teachers, as experts in the content areas and the integration of disciplines, offer support and act a mentor to classroom teachers willing to implement a new strategy. Utilize or build leadership skills to help grow a learning community of teachers focused on creating students adept at using 21st century skills. STEM teachers should realize their place as an expert and help to provide classroom teachers added supports to grow their confidence and build their capacity.

Administrators.

Administrators are able to facilitate change through the allocation of resources. Resources such as time for teachers to plan, staff to support instruction, and the adoption of curriculum beyond tested subject areas. School leaders who are seeking to change the culture to embrace the arts needs to have a strong belief in why the arts are important in education. Administrators need to seek ways to best professionally develop teachers growing teacher capacity, and follow through with evaluation to promote sustainability. There is great value in a supportive administrator, who is an instructional leader.

Teacher Preparation Programs.

Teacher preparation programs have a duty to fully prepare preservice teachers in curriculum use, lesson planning and content delivery. Teachers are entering the field as experts in the area of one or two content areas. Teacher preparation programs need to be revised to provide the same amount of methods courses in science, math, and arts as they provide for

reading instruction. There is need to build capacity in teachers so they might rely on the experience to guide their lesson integration once they have their own classrooms.

Future Research

A great body of research exists on the positive outcomes of an arts integrated curriculum. A national push for stronger STEM instruction at the collegiate level has propelled many educators to begin to implement STEM programs in K-12 settings, but a gap exists where STEM and arts integration are coupled together to meet learner needs.

A next step in this research would be to conduct a quantitative study to track student achievement after participation in STEAM practices over time. Adjustments to the amount of time spent implementing STEAM, as well, as the instructional strategies used such as direct instruction versus indirect instruction, or the types of collaborative tasks used might give greater insight into program success.

Researchers could further explore the idea of teacher efficacy and the tipping point when facilitating attitudes precede constraining behaviors and how to shift teacher comfort to teacher confidence. Researchers could identify how each of these realizations help to identify the false sense or facade of teacher efficacy to prevent the learning curve which comes with new program implementation.

This study has sought to describe the lived experience of seven participants who created a space for STEAM within their classrooms. It brought to light veterans in the field did not have a common definition for arts integration, a common expectation for co-teaching, or a central idea for outcomes. Findings from this study suggest that implementation for STEAM practices can be improved by providing ongoing support. STEAM implementation was best enacted by the

STEM teacher with facilitating support from the classroom teacher. Ongoing support through professional development focused in the areas of co-teaching, arts integration, and STEAM.

To further create a sustainable STEAM implementation I would suggest a lesson study model, using a teaching triad. Three teachers would plan over a period of time to work on lesson design, implementation, assessment, and improvement. During this continuous cycle teachers identify a focus, carefully plan and collaborate, observe other teachers, record the lessons for analysis and reflect, and finally discuss and share with their colleagues and administrators (Rock & Wilson, 2005).

Conclusion

The school in this study is filled with teachers with facilitating attitudes. It is filled with teachers whom given resources, direction, and a framework outlining collaboration, peer observations, and time to reflect, have the capacity to gain confidence and create a sustainable STEAM program. It is guided by a willing team of administrators who are committed to allocating resources to make sure students are engaged in meaningful learning experiences, and are willing to explore curriculum options which will drive students to higher levels achievement. The stories described in this study are much like the stories in many elementary schools, teachers comfortable in their position, comfortable in their profession hidden by a facade of teacher efficacy.

As a stakeholder, discover where you can add value to the efforts to incorporate or support arts integration. In order for students to be prepared to compete in an ever changing society, they must be able to think creatively, work collaboratively, and translate thinking skills from one discipline to another to problem solve. We must find paths to create confident learners willing to take on the future, by thinking outside of their learned comfort.

List of References

References

Ananiadou, K., & Claro, M. (2009). *21st Century Skills and Competences for New Millennium Learners in OECD Countries*(Working paper No. 41). Paris.

Antilla, E., Barrett, T., Haseman, B., Ruthmann, S.A. (2015). Learning Across Disciplines: A Collective Case Study of Two University Programs That Integrate The Arts With STEM *International Journal of Education & The Arts,* 16 (7) 1-21.

Azzam, A. (2014). Motivated to Learn: A Conversation with Daniel Pink. *Educational Leadership*, *72*(1), 12-17.

Boston, M. (2012). *Instructional Quality Assessment* [Rubrics Rating Accountability Talk].

Breiner, J., Harkness, S., Johnson, C., Koehler, C. (2012). What is STEM? A Discussion About Conceptions of STEM in Education and Partnership. *School Science and Mathematics,* 112 (1). https://doi-org.umiss.idm.oclc.org/10.1111/j.1949-8594.2011.00109.x

Burdette, M. (2011). Arts Integration: The Authentic Context for 21st Century Learning. Retrieved August 6, 2018, from http://centerforartsintegration.org/articles/arts-integration/

Cerveny, K. (2001, September 1). Elliot Eisner, The Role of the Arts in Education the Whole Child. Retrieve April 1, 2015, from http://www.giarts.org/article/elliot-w-eisner-rolearts-educating-whole-child

Creswell, J. W. (2011). *Research Design* (4th ed.). Los Angeles, CA: SAGE Publications.

Creswell, J. W. (2013). *Qualitative Inquiry & Research Design: Choosing Among Five Approaches* (3rd ed.). Los Angeles, CA: SAGE Publications.

Committee on STEM Education National Science and Technology Council. (2013). *Federal Science, Technology, Engineering, and Mathematics (STEM) Education 5-Year Strategic Plan.* Washington, D.C.

Cornett, C. (2006). Center stage: Arts-based read-alouds. *Reading Teacher,* 60, 234-240.

Costa, A., & Kallick, B. (1993). Through the Lens of a Critical Friend. *Educational Leadership,*51(2), 49-51.

Dow, M. J., & Thompson, K. W. (2017). Co-teaching across STEM Disciplines in the ESSA Era of School Librarians as Teachers. *Teacher Librarian*, 45 (March/April).

DuFour, R. (1998). *Professional Learning Communities at Work: Best Practices for Enhancing Student Achievement*. Bloomington, IN: Solution Tree Press.

DuFour, R., DuFour, R., Eaker, R., & Many, T. (2010). *Learning By Doing*(Second ed.). Bloomington, IN: Solution Tree Press.

Federal Science, Technology, Engineering, and Mathematics (STEM) Education 5-Year Strategic Plan (Rep.). (2013). Washington, D.C.: Committee on STEM Education National Science and Technology Council.

French, B., McDuffie, A. R., & Morrison, J. (2015). Identifying Key Components of Teaching and Learning in a STEM School. *School Science and Mathematic*s, 115(5), 244-256.

Geisinger, K. (2016). 21st Century Skills: What Are They and How Do We Assess Them? *Applied Measurement in Education,*29(4), 245-249. http://dx.doi.org/10.1080/08957347.2016.1209207

Granovskiy, B. (2018). *Science, Technology, Engineering, and Mathematics (STEM) Education: An Overview.* Washington, D.C.: Congressional Research Service.

Groenewald, T. (2004). A phenomenological research design illustrated. *International Journal of Qualitative Methods, 3(1).*

Husserl, Edmund. 1967. "The Thesis of the Natural Standpoint and Its Suspension." Pp. 68-79 in *Phenomenology*, edited by J. J. Kockelmans. Garden City, NY: Doubleday. 1913. *Ideas*. London: George Allen and Unwin. Republished 1962, New York: Collier.

Jensen, E. (2005). *Teaching with the Brain in Mind*(2nd ed.). Alexandria, VA: ASCD.

Lapek, J. (2017). 21st Century Skills: The Tools Students Need. *Children's Technology and Engineering,* 24-26.

Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic inquiry* (vol 75). Beverly Hills, CA: Sage.

Maslyk, J. (2016). *STEAM Makers: Fostering Creativity and Innovation in the Elementary Classroom*. Thousand Oaks, CA: Corwin.

Milacci, F., & Zabloski, J. (2012). Gifted Dropouts: Phenomenological Case Studies of Rural Gifted Students. *Journal of Ethnographic and Qualitative Research, 6*, 175-190. Retrieved March 8, 2016.

National Board for Professional Teaching Standards. (2014) *Five core propositions*. Retrieved from http://www.nbpts.org/five-core-propositions

National Governors Association Center for Best Practices, Council of Chief State School Officers (2010). *Common Core State Standards.* Washington D.C. National Governors Association Center for Best Practices, Council of Chief State School Officers.

NGSS Lead States. (2013). *Next Generation Science Standards: For states, by states*. Washington, DC: National Academies Press. *www.nextgenescience.org/next-generation-science-standards.*

Nixon, B. (2013). Arts Integration: What's the Problem? *General Music Today,26*(2). Retrieved August 7, 2018.

Partnership for 21st Century Skills. (2009). Framework Definitions. Retrieved from http://www.p21.org/about-us/p21-framework

Patton, M. Q. (2002). *Qualitative Research and Evaluation Methods* (3rd ed.). Thousand Oaks, CA: SAGE Publications.

Quigley, C. F., Jamil, F. M., & Herro, D. (n.d.). Developing a Conceptual Model of STEAM Teaching Practices. *School Science and Mathematics,117*(1-2), 1-12. Retrieved August 26, 2018.

Remer, J. (2003) Artist-Educators In Context: A Brief History of Artists in K-12 American Public Schooling, Teaching Artist Journal, 1:2, 69-79, DOI: 10.1207/S1541180XTAJ0102-02

Riley, S. (2014). *No Permission Required: A Guide for Bringing S.T.E.A.M to Life*. Westminster, Maryland: Visionyst Press.

Rotherman, A. J., & Willingham, D. (2009). 21st Century Skills: The Challenges Ahead. *Educational Leadership,* 16-22. Retrieved July 15, 2018.

Schleicher, A. (n.d.). The Case for 21st-century learning. Retrieved August 22, 2018, from http://www.oecd.org/general/thecasefor21st-centurylearning.htm

Silverstein, L., & Layne, S. (2010). Defining Arts Integration. Retrieved August 7, 2018, from http://www.kennedy-center.org/education/partners/defining_arts_integration.pdf

Smith, R. (2018). *Supporting Novice Teachers in Critical Needs Schools.* (Doctoral dissertation).

Sorrentino, J. (2014, May 15). Science Labs in Elementary Schools? Retrieved March 31, 2015, from http://www.education.com/magazine/article/Science_Labs_Elementary_School/

Sousa, D., & Pilecki, T. (2013). *From STEM to STEAM Using Brain-Compatible Strategies to Integrate the Arts*. Thousand Oaks, California: Corwin.

Stapp, A. C. & Wolff, K. (2017). Young children's experiences with yoga in an early childhood setting. *Early Child Development and Care.* Retrieved from https://doi.org/10.1080/03004430.2017.1385607

Tillman, T. (2018). *Implementation LETRS* (Doctoral dissertation).

Turner, M. (2015). *The Arts are Not Fluff: Understanding the Barriers of Art Education in Utah* (Masters Thesis).

Van Manen, Max. 1990. *Researching Lived Experience: Human Science for an Action Sensitive Pedagogy.* New York: State University of New York.

United States, United States Government Accountability Office. (2018). *Science, Technology, Engineering, and Mathematics Education Actions Needed to Better Assess the Federal Investment* (pp. 1-46). Washington D.C.: GAO.

Wang, H., Moore, T. J., Roehrig, G. H., & Park, M. S. (2011). STEM Integration: Teacher Perceptions and Practice. *Journal of Pre-College Engineering Education Research, 1*(2), 1-13. Retrieved February 23, 2016.

Wilson, H.D. (2018). *The Improvement of Absenteeism at Learning Elementary School* (Doctoral dissertation).

Wang, X. (2013). Why Students Choose STEM Majors. *American Educational Research Journal,50*(5), 1081-1121. doi:https://doi.org/10.3102/0002831213488622

Young, A., & Fulwiler, T. (1986). *Writing Across the Disciplines Research Into Practice.* Montclair, New Jersey: Boynton/Cook Publisher, Inc.

LIST OF APPENDICES

APPENDIX A

APPENDIX A

APPENDIX A: INTERVIEW PHASE I

Interview Phase I

General Research Topic: What does creating a space for STEAM look like?

Specific Research Question: How do teachers describe their experience of learning to teach STEAM at Learning Elementary School?

Conceptual Frameworks: Arts integration, STEM, Professional Learning Community,

Teacher Interview Questions

Icebreaker:

1. How old are you?
2. What grade do you teach? How long have you been teaching?
3. Tell me about your teaching/educational background. Have you taught anywhere other than your current school? What grades have you taught?

Arts Integration:

1. How would you define arts integration?
2. How often do you utilize art in your classroom?
3. What hinders you from planning art lessons for your students?
4. How comfortable as a teacher are you implementing an arts based project in your instruction?

5. Do you think students participate in more arts integrated lessons in elementary grades than in higher grades? (1-2) Why do you think this is/isn't the case?

STEM

1. How would you define STEM?
2. How have your students benefited from the STEM lab?
3. How does the STEM lab support you as a teacher?
4. Are there past reasons you have not incorporated STEM into your instruction?
5. Tell me about a current or former student who would or is benefitting from the STEM lab.

Professional Learning Community:

1. What is the most valuable part of being involved in a professional learning community?
2. Do you feel supported by your colleagues within your PLC? If so, how?

Closing:

What should I have asked you that I didn't think to ask?

INTERVIEW PHASE II

Teacher Interview Questions

Ice Breaker:

1. Describe your classroom during STEAM instruction; what would be seen if observing in your classroom during this time?

Study Impact:

Arts Integration

1. How comfortable as a teacher are you implementing an arts based project in your instruction?

STEM

1. How comfortable as a teacher are you implementing a STEM lesson in your instruction?

STEAM

1. How comfortable as a teacher are you implementing a STEAM lesson in your instruction?

Professional Learning Community

1. How did your participation in a Professional Learning Community impact your implementation of STEAM?
2. How could the Professional Learning Community experience be enhanced?

STEAM Sustainability:

1. Would you continue implementing STEAM lesson in your instruction?
2. What additional resources would be beneficial for continued STEAM instruction?
3. What challenges need to be addressed?

4. What recommendations would you give to other practitioners at the onset of STEAM implementation?
5. How would you describe your co-teaching experience?

Closing:

What should I have asked you that I didn't think to ask?

APPENDIX B

APPENDIX B
Interview Protocol

Interviews will take place at the school site in a private room. The researcher will ask the interviewee for permission to audio record the interview. Explain that at any time, the interviewee can request to pause the recording or stop the interview. The interview should take approximately fifteen minutes.

The researcher will:

- de-identify all personal information (name, school, students' names, coworkers' names etc.)
- assign Pseudonyms for all interviewees
- transcribe the recorded interviews, and
- keep transcriptions and audio files secure.

V I T A

F E L I C I A B R O W N P O L L A R D

FELICIABROWNPOLLARD@GMAIL.COM

EDUCATION

Doctorate of Education 2019
University of Mississippi
Elementary Teacher Education
Dissertation: Creating a Space for STEAM, a qualitative multiple-case study analysis

Educational Specialist 2012
University of Mississippi
Educational Leadership

Master of Education 2006
University of Mississippi
Curriculum and Instruction,

Bachelor of Arts in Education
University of Mississippi 2005
Elementary Education

CERTIFICATIONS AND LICENSURE

National Board Certification: 2010
Early Childhood Generalist

Mississippi Department of Education
Kindergarten K-4
Elementary Education 4-6
English 7-12
Social Studies 7-12
Gifted K-12
Driver Education 7-12
Career Level Administrator

WORK OF EXPERIENCE

July 2012- Present Lafayette County School District Oxford, MS
Assistant Principal

- Created common assessments to provide teachers valuable insight into student

performance
- Aligned curriculum for second and third grades to prevent a gap in student achievement during building level transition
- Designed "Jumpstart", a summer school program, developed to provide struggling second graders the opportunity to explore third grade curriculum
- Partnered with The University and performed as an administrative mentor for Principal Corps candidates

August 2015- May 2018 The University of Mississippi Oxford, MS
Adjunct Professor
- Worked collaboratively with faculty team to develop course materials
- Taught undergraduate students EDCI 351, EDRD 400, EDRD 414, EDCI 353, EDEC 557
- Worked closely with University faculty & community members to provide relevant perspectives for graduating seniors.
- Maintained adequate records utilizing online course interface

June 2011- June 2012 Lafayette County School District Oxford, MS
Administrative Intern
- Fostered relationships with teachers, students, and parents
- Gathered resources to aid teachers in implementing Common Core Standards
- Worked closely with the administrative staff to promote school safety
- Applied current research to meet the needs of both faculty and students

August 2008- July 2011 Pontotoc City School District Pontotoc, MS
Second Grade Teacher
- Integrated technology into units to motivate and educate all learning styles
- Utilized assessments to develop and drive instruction
- Infused the arts into units to promote student interest and ownership of learning
- Collaborated with local charities to raise classroom and school awareness to the benefit of service learning

August 2006- July 2008 Tupelo Public School District Tupelo, MS
Second Grade Teacher
- Collaborated with peers to develop cooperative learning experiences
- Differentiated instruction to create meaningful experiences for children at all levels
- Created a learning environment that supported equity, fairness, and diversity

PRESENTATION

2019 STEM Teacher's/Coaches Industry Trainer's Conference
Digging Deeper, Laying the Foundation for STEM Education

EXTRACURRICULAR HONORS

Phi Kappa Phi
Outstanding Doctor of Education Degree Student Award in Elementary Education 2017
Algernon Sydney Sullivan Award for Service 2015 Finalist
Pontotoc Elementary Teacher of the Year 2011
Semi Finalist Mississippi Recycling Coalition Teacher Award