A Seminar Paper

The attached seminar paper, by Kirk S. Nichols, entitled, THE CORRELATION OF EARLY STEM EDUCATION AND EDUCATOR DISPOSITION, when completed, is to be submitted to the Graduate Faculty of the University of Wisconsin-Platteville in partial fulfillment of the requirements for the Master of Science in Education Degree, for which 3 credits shall be allowed, is hereby

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THE CORRELATION OF EARLY STEM EDUCATION AND EDUCATOR DISPOSITION

A Seminar Paper

Presented to

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University of Wisconsin-Platteville

In Partial Fulfillment of the

Requirement for the Degree

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in

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by

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ABSTRACT

The integration of science, technology, engineering, and math, better known as STEM, can be seen in today's classrooms starting as early as kindergarten or earlier. With an ever increasingly high demand for student performance and success, educators struggle to find the time and effort toward implementing topics, specifically STEM, into their curriculum. This study investigates the changes made to an educator's disposition toward the implementation of STEM in their classrooms after receiving support through STEM professional development and learning opportunities.

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CHAPTER I

INTRODUCTION

Statement of the Problem

Research continues to show how important it is to start exposing students to Science, Technology, Engineering, and Mathematics (STEM) education in the early elementary years. The U.S. Department of Education's Office of Innovation and Improvement reports:

> For STEM education to have the desired effect of developing individuals' lifelong learning skills, as well as the potential for sustained interest in STEM topics and issues, children and youth should be exposed to positive and authentic STEM learning experiences as early as preschool and throughout their educational pathways (Moomaw, Davis, 2010). Introducing students to STEM early in their education, in both informal and formal learning settings, capitalizes on children's innate interest in the world around them. As Russell Shilling, the U.S. Department of Education's executive director of STEM remarked, "Every child is imbued with a sense of curiosity and wonder. They are born scientists, engineers, and creators ready to discover the world at every turn. The goal of education should be to sustain engagement through a lifetime." (Moomaw, Davis, 2010; Shilling, 2015, para. 1 as cited in U.S. Department of Education, 2016)

In the *Journal of STEM Teacher Education (2014)*, Anthony Murphy, Executive Director of the National Center for STEM Elementary Education notes:

> We need to begin STEM education early with our children, certainly in elementary school and possibly even younger. Children … are natural scientists, engineers, and problem solvers. They consider the world around them and try to make sense of it the best way they know how by touching, tasting, building, dismantling, creating, discovering, and exploring. For kids, this isn't education. It's fun! Yet, research documents that by the time students reach fourth grade, a third of boys and girls have lost an interest in science. By eighth grade, almost 50 percent have lost interest or deemed it irrelevant to their education or future plans … . That means that millions of students have tuned out or lack the confidence to believe they can do science [or pursue a future in STEM]. (Murphy, 2011, para. 5, as cited in Daugherty, Carter, Swagerty, 2014)

It is equally as important and vital that elementary educators are invested and are motivated to educate their students in the area of STEM.

Currently some elementary-level educators are finding it hard to become motivated to incorporate STEM into their classrooms. Constraints such as lack of time, lack of training, lack of self-efficacy, and lack of motivation are seen time and time again.

Problem Question

Does experiencing STEM learning opportunities, scaffolded to build STEM literacy, affect an educator's disposition and motivation toward teaching STEM?

Definition of Terms

Early Childhood: Describe[s] the period from birth through age 8. Today's young children spend their days in a variety of settings across these early years, including their homes and their relatives' or neighbors' homes, informal learning environments such as libraries and museums, child care centers and home-based family care settings, pre-K classrooms, kindergarten classrooms, and primary or elementary schools (McClure, Guernsey, Clements, Bales, Nichols, Kendall-Taylor, Levine, 2017).

Deeper Learning: The process through which an individual becomes capable of taking what was learned in one situation and applying it to new situations (National Research Council, 2012).

Disposition: Describes the values, commitments, and professional ethics that influence behaviors toward students, families, colleagues, and communities. These behaviors affect student learning, motivation, and development as well as the educator's own professional growth (National Council for Accreditation of Teacher Education, 2001).

NAE: National Academy of Engineering

NRC: National Research Council

Purpose of the Study

The purpose of this study was to identify the importance of incorporating STEM in the early years of education, as well as to research the impact of providing STEM learning opportunities on an educator's disposition and motivation. Hypothesis: provision of STEM learning opportunities in and out of the classroom will result in kindergarten educators improving their dispositions and motivations toward including STEM investigations and curricula in their classroom communities. If it is conjectured that there is evidence that shows an increase in these aspects, then there can be a positive impact on classroom communities and student excitement toward STEM education.

> Teachers do play a critical role in the development of STEM engagement for young learners. Teachers who are confident and enthusiastic about STEM topics, and who engage their students in developmentally tailored STEM activities, pass that excitement to their students. (McClure, et al., 2017, pg. 21)

Significance of the Study

The science curriculum at the kindergarten level in the Mount Horeb Area School District is currently not clearly defined and therefore not cohesive. The district has nine different sections of kindergarten with nine different classroom educators, all of whom have various expertise, opinions, and motivation toward the teaching of science and/or STEM. Currently, the Mount Horeb Area School District is working to make the subject of science more consistent across grade levels and more streamlined as students progress from grade level to grade level.

The research and study I conducted can be significant in that it can help increase the Mount Horeb Area School District's awareness of why including STEM in the early years of education is essential for both students and educators alike. This awareness could lead to future discussions and possible implementation of STEM education district-wide.

Assumptions

Throughout this research and study, assumptions have been made. The following are a few assumptions:

- Early childhood students include 5- and 6-year-olds (kindergarten-aged students).
- Students are excited about and enjoy STEM investigations.
- Educators are STEM literate and know how properly implement it.
- Educators enjoy science, mathematics, engineering, and technology.
- Educators are open to and willing to try something new.
- Educators directly affect their students' excitement regarding STEM.
- Administration is supportive of and will allow time for STEM implementation.

Delimitations of Research

My survey was done with Kindergarten educators in the Mount Horeb Area School District (Mount Horeb, WI). It focused directly on one grade level, one school district, one city, and one state and may not be reflective of higher grade levels, different school districts, or different cities, states, or countries. Time could also be seen as another influencing factor. Participants took the pre-survey at the beginning of the school year (August, 2018) and took the post-survey at the beginning of November, 2018. The survey data was reflective of 12 weeks of school. The research that contributed to this study was done largely online since much of the current literature is presented technologically.

Method of Approach

Identification of Relevant Information

The identification of relevant information has been done through my research using primary sources and secondary sources. The conducted research was completed by using search engines through the University Libraries (https://www.uwplatt.edu/library), which included the following types of resources: articles, journals, studies, and theses and seminar research papers.

Methodology

The method used for research was the descriptive method of survey research. I used the survey before the school year began as a pre-test/survey and again in the month of November as a post-test/survey. The survey consisted of questions that focused on educator disposition and motivation toward STEM education.

After completing my data for both pre-test/survey and post-test/survey for my survey research, I used a hypothesis test to determine if I had meaningful results. I used paired data because I used a pre-test/survey and post-test/survey (surveying my colleagues twice.) I collected my data and put it into a Microsoft Excel spreadsheet to show a comparison for the pre-test/survey and post-test/survey results (t-test). I then showed the comparison of the pre-test/survey data and post-test/survey data using a bar graph. The next step was taking a look at the P-value which shows that there is evidence to reject the null hypothesis. Finally, I made conclusions from my findings.

CHAPTER II

REVIEW OF LITERATURE

What is STEM?

> A common definition STEM education is an interdisciplinary approach to learning where rigorous academic concepts are coupled with real-world lessons as students apply science, technology, engineering, and mathematics in contexts that make connections between school, community, work, and the global enterprise enabling the development of STEM literacy and with it the ability to compete in the new economy. (Tsupros, 2009, as cited in Gerlach, 2012)

Although STEM may have an exact definition, the meaning could be interpreted many different ways as it is viewed through a variety of lenses. The definition may take on a specific meaning unique to each individual group. Gelach (2012) shares, "I think it is truly impossible to define STEM because it means so much for so many different groups of people." He believes in one commonality among all of the definitions stating, "it is about moving forward, solving problems, learning, and pushing innovation to the next level."

Spaepen (2017) asserts that "the STEM disciplines…share a set of foundational processes and practices" (p.7). Furthermore, "many of the central concepts, practices, and dispositions of the STEM disciplines build on and are connected to one another. At the same time, the STEM disciplines are distinct, with discipline-specific characteristics and knowledge" (Spaepen, 2017, p.7). The connectivity and relationships among the four disciplines of STEM play an important role in the education world. The STEM Task Force Report (2014) notes "STEM education is far more than a convenient integration of its four disciplines, which cannot and should not be taught in isolation, just as they do not exist in isolation in the real world or the workforce" (The STEM Task Force Report, 2014, as cited in English, 2017).

Why STEM?

In an ever-changing world of academics and increasingly high demands in education, educators continue to feel the strain of finding time and effort to meet the already rigorous required curriculum in their classrooms that includes heavy emphasis on literacy and mathematics. With this being so, the question is posed: why should educators include STEM in their classroom communities?

Lantz believes that STEM is important because, through it, students receive the "best opportunities to make sense of the world holistically, rather than in bits and pieces. STEM education removes the traditional barriers erected between the four disciplines, by integrating them into one cohesive teaching and learning paradigm" (2009). Spaepen agrees that providing STEM opportunities allows students to build their academic skills among all of the academic areas of learning. STEM opportunities entitle students to "develop critical thinking, executive functioning, and problem solving skills that cut across subject areas (within and outside of STEM disciplines) and that set the stage for how they approach learning and thinking about rich content into the future" (Spaepen, 2017). Through this approach to learning, students begin to build their new knowledge by connecting it to their prior knowledge and experiences. This type of learning is defined as "deeper learning." "While other types of learning may allow an individual to recall facts, concepts, or procedures, deeper learning allows the individual to transfer what was learned to solve new problems" (National Research Council, 2012). STEM education provides an opportunity for students to experience this deeper learning approach.

According to the National Academy of Engineering (NAE) and National Research Council (NRC), the necessity of STEM education exists because the traditional approaches to teaching these contents do not appeal to today's students.

> Some of the impetus for integrated STEM education is undoubtedly driven by dissatisfaction with traditional approaches to science and mathematics education in the United States. Although decades of education reform have brought significant changes to curricula, standards, and professional development in these subjects, much science and mathematics teaching still emphasizes rote skills and memorization; relatively few K–12 students express interest in pursuing these subjects in college or as a career; and the performance of US students on international comparative assessments is below what many feel is adequate, given how expertise in these subjects helps fuel the nation's innovation engine. (NAE and NRC, 2014)

Educators must pique student interest in science and mathematics. "Fostering the development of students' interest and identity in STEM is an important potential outcome of integrated STEM experiences" (NAE and NRC, 2014). The NAE and the NRC believe this interest and identity can "lead to continued engagement in STEM-related activities as reflected in course selection and choice of out-of-school activities, college major, and career path" (2014).

The inclusion of STEM education could help lead students into further schooling centered on STEM and possibly a future career in STEM. "The impetus for including integrated STEM instruction in preK–12 classrooms and in higher education is largely justified by a workforce imperative...there is great concern that in the United States, not enough young people are being trained in STEM fields" (Robeck, n.d.). In fact, the U.S. Department of Education Office for Civil Rights, *Civil Rights Data Collection*: Data Snapshot: College and Career Readiness (2014) agrees that, "STEM fields are the gateway to America's continued economic competitiveness and national security" (U.S. Department of Education, Office of Innovation and Improvement, 2016, p.2). STEM is an essential part of American education because it is "seen as a vehicle by which the United States will continue to be at the forefront of technological innovation, especially in ways that enhance economic opportunities, improve the quality of life, and address environmental challenges" (Robeck, n.d.).

The Importance of Early STEM Education

A curriculum in STEM education in early education becomes essential for today's learners. Incredibly, the inclusion of STEM education could start as early as the preschool level. The Institute of Medicine (IOM) and NRC reveal, "…research shows that preschool children know a great deal about the natural world, including concepts related to physics, biology, psychology, and chemistry" (NRC, 2007, as cited in IOM and NRC, 2015). IOM and NRC go on to affirm that young children are also "fascinated with and construct many ideas about how the world works. They investigate and refine these ideas by exploring and questioning the world around them...they also possess thinking skills and habits of mind that support later, more sophisticated, scientific reasoning" (2015).

Preschool-aged students are developmentally prepared for the components of STEM. "Evidence indicates that even preschool and early elementary students can make meaningful progress in conceptual organization, reasoning, problem solving, representation, and communication in well-chosen topic areas in science, mathematics, and language arts" (NRC, 2012). Weyer also agrees with the notion that young students possess the developmental skills required for STEM. "Research has demonstrated that when young children enter school, they already have substantial knowledge of the natural world, can think both concretely and abstractly, use a range of scientific reasoning processes, and are eager, curious and ready to learn" (Weyer, 2018).

Surprisingly enough, STEM currently exists in a preschoolers' day during their free choice/play time. "Preschoolers' free play involves substantial amounts of foundational math. Regardless of their income level and gender, preschoolers explore patterns, shapes, and spatial relations; compare magnitudes; and count objects" (Clements and Sarama, 2016). Weyer agrees in the prevalence of mathematical skills among preschool-aged learners.

> Research has demonstrated that young children's minds are very receptive to math and logic and that early mathematics skills are the strongest predictor of future academic achievement. Developing math skills, along with other STEM skills in high-quality, P-3 [Preschool - 3rd grade] environments couples the predictive power of learning STEM skills with the academic growth and trajectories that high-quality early learning can provide (Weyer, 2018.)

Young preschool students demonstrate a readiness for STEM education to be implemented in their classrooms at an early age. "Whether it is gardening, building forts, stacking blocks, playing at the water table, or lining up by height in the classroom, children demonstrate a clear readiness to engage in STEM learning early in life" (McClure, et al., 2017).

Preschool provides a stepping-stone and introduction into a student's first experience with STEM. Following this, a student's STEM career continues to grow in elementary school within the kindergarten classroom. "Entering kindergartners possess knowledge of the natural world, including some understanding of things like cause and effect; the differences between animate and inanimate objects...this knowledge includes concepts related to physics, biology, psychology, and chemistry" (Clements, et al., 2016). Elementary school, and more specifically, kindergarten, provides the perfect setting/environment for the implementation of STEM education, as students are just starting their school careers and are unbiased. "Research suggests that elementary school is the most appropriate time to engage students in integrated STEM education and spark the interest of elementary-aged students—particularly in science, technology, engineering, and mathematics" (Daugherty, et al., 2014). This interest in and early exposure to STEM education "positively impacts elementary students' perceptions and dispositions (Bagiati, Yoon, Evangelou, & Ngambeki, 2010; Bybee & Fuchs, 2006, as cited in Daugherty, et al., 2014). Further, "By capturing students' interest in STEM content at an earlier age, a proactive approach can ensure that students are on track through middle and high school to complete the needed coursework for adequate preparation to enter STEM degree programs at institutions of higher learning" (Daugherty, et al., 2014). DeJarnette further agrees upon this, "Not only do STEM lessons and activities excite young learners, but they also build their confidence and self-efficacy in relation to their own abilities to be successful in more advanced math and science courses in later school years" (2012).

"STEM education encourages exploration and problem solving in ways that apply, create, assess, and adjust technologies through activities that are intended to be as authentic as possible" (Robeck, n.d.). Encouragement through exploration and problem solving has a positive impact on students. "Many STEM activities involve students in designing and building structures and products, so that they can feel the sense of accomplishment that comes from applying knowledge and skills to solve problems" (Robeck, n.d.) Inclusion of STEM education provides students with an opportunity to develop their skills and characteristics. As Morrison (2016) lists, students expand their skills as:

- Problem-solvers – able to define questions and problems, design investigations to gather data, collect and organize data, draw conclusions, and then apply understandings to new and novel situations.
- Innovators – creatively use science, mathematics, and technology concepts and principles by applying them to the engineering design process.

- Inventors – recognize the needs of the world and creatively design, test, redesign, and then implement solutions (engineering process).
- Self-reliant – able to use initiative and self-motivation to set agendas, develop and gain self-confidence, and work within time specified time frames.
- Logical thinkers – able to apply rational and logical thought processes of science, mathematics, and engineering design to innovation and invention. (Lantz, 2009, p.3)
- Technologically literate - understand and explain the nature of technology, develop the skills needed, and apply technology appropriately (Morrison, 2006, as cited in Lantz, 2009.)

Early STEM education can also directly correlate to impacting student dispositions. Educators must help to shape our youngest learners, set the tone, and model the importance of STEM in early learning.

> Children's attitudes about STEM and about themselves as STEM learners are formed early. Children's earliest experiences with science, technology, engineering, and mathematics set the stage for their later engagement and success in those fields; if we fail to give all children access to high quality early STEM experiences, instead providing either inferior quality STEM experiences or no STEM at all, they may very well lose interest in STEM topics or lose confidence that they can "do" STEM. Because children often inadvertently receive both subtle and not-so-subtle negative messages from adults about STEM, providing positive opportunities early to shape their attitudes and beliefs about their ability to succeed in STEM matters all the more. (Spaepen, 2017)

STEM Connections

The definition of STEM encompasses the academic areas of science, technology, engineering, and math. Although these four areas share equal importance in a student's education, the question remains: how does STEM connect with other academic areas besides the four described by its acronym? Furthermore, how does STEM connect with the "real-world" outside of school?

According to research discovered by Brenda Bunn, "Students learn best when concepts are integrated which makes STEM a highly desirable learning environment" (Moomaw, Davis, 2010, as cited in Bunn, 2015). The inclusion of STEM provides an opportunity for the interdependence of multiple academic areas. “The concept of STEM extends across content areas (e.g., science, math, language arts, and art/design) by encouraging students to develop solutions that incorporate a variety of disciplines” (Basham, Israel, & Maynard, 2010, as cited in Basham, 2013).

STEM has a strong connection with literacy. “Experts have long recognized that the practices associated with STEM invite children to engage in many forms of literacy...STEM provides a context for learning across the four English Language Arts strands identified in the Common Core state standards” (McClure, et al., 2017). A relationship exists between a student's success in literacy and STEM, as STEM contributes “to other developmental goals, such as language and executive function” (Clements, Sarama, 2016). Literacy and technology also intersect when students, particularly kindergarten students, engage in “hands-on activities such as using iPads to draw observations of plants and animals. Utilizing literacy skills such as reading and writing to document and share hypotheses is also something a kindergartner can do” (Weyer, 2018). Providing STEM opportunities will allow students to make connections between multiple literacy skills.

> Giving children opportunities to engage in scientific exploration supports science learning, but it also fosters learning and school readiness in other subject areas and developmental domains, including language and literacy, mathematics, and learning competencies (Gelman et al., 2009). Consistent science experiences are related to children’s vocabulary growth (French, 2004) and use of more complex grammatical structures, such as causal connectives (Peterson and French, 2008). Further, the knowledge that children build about the natural world is a critical contributor to later achievement not only in science but also in reading (Grissmer et al., 2010). (Gelman et al., 2009; French, 2004; Peterson and French, 2008; Grissmer et al., 2010; as cited in IOM and NRC, 2015.)

The most effective STEM education allows for an integrated curriculum that transfers knowledge and skills across all academic areas.

> The goals included in the new standards and the NRC science framework reflect each discipline's desire to promote deeper learning and develop transferable knowledge and skills within that discipline. For example, both the mathematics standards and the science framework include a "practices" dimension, calling for students to actively use and apply—i.e., to transfer—knowledge, and the English language arts standards call on students to synthesize and apply evidence to create and effectively communicate an argument (NRC, 2012).

This transfer of knowledge requires students to make connections across academic areas and helps them to make better sense of what they are learning. "In integrated STEM learning experiences, students often need to make connections across different kinds of representations from a single discipline and learn to recognize how representations from different disciplines are related" (NAE, NRC, 2014). The NAE and NRC further state that:

> Integrated STEM educational experiences, by design, ask students to engage in the transfer of disciplinary knowledge and, ideally, enable the students to reliably transfer their knowledge to other areas and activities in the future. Transfer can be explored at a variety of levels—from one context to another, one set of concepts to another, one school subject to another, one year of school to another, across school, and to everyday nonschool activities (NAE and NRC, 2014.)

STEM education provides students with connections to the real-world. According to the U.S. Department of Education, STEM is vital, as it provides an opportunity for individuals to be involved with solving challenges that may be local, national, or possibly global.

> Research suggests that "interdisciplinary learning can foster an understanding of STEM concepts in their application to real-world problems, problems that by their very nature are interdisciplinary" (Asghar, Ellington, Rice, Johnson, & Prime, 2012, p. 86). In the field, scientific and technological innovations are not developed in a discipline-specific vacuum but instead by an interdisciplinary team-based approach to solving local, national, and global challenges (U.S. Department of Education, Office of Innovation and Improvement, 2016.)

The Role of the Educator

The foundation for successful STEM integration starts with the educator. Educators' personal opinions toward STEM, professional development, and overall motivation and drive toward implementation directly affect their students' connections with STEM.

> If more children are to enter the STEM pipeline, then teachers in early elementary grades need to be prepared to provide interesting and engaging lessons that focus on developing children's problem-solving and spatial ability while encouraging their intrinsic interest in STEM. (Daugherty, et al., 2014)

In order for STEM education to be successful, an educator must demonstrate a positive attitude toward implementing it. These positive attitudes leave a lasting impression on students. "Elementary teachers, as mentors, play a critical role in supporting science learning and research suggests that negative comments by teachers have a greater effect than positive comments at influencing the attitudes of young children" (Redd and Winston, 1974; Bell et al., 2009, as cited in Marcum-Dietrich, Marquez, Gill, Medved, 2011). Students, especially in the early years of education, need positive guidance from quality educators. "Although young children often show great natural curiosity about the world and remarkable capacity to learn on their own, they need adult assistance to foster, guide, and build on their interests to ensure adequate early STEM experiences" (Spaepen, 2017). Spagepen further maintains that educators "play an important role in understanding how and when to ask the next question, remind children of a counterexample, or sometimes even just add a new fact or piece of information that children do not know" (2017).

According to the NAE and NRC, educators should create learning opportunities that allow students to actively engage with learning. Educators must be "attentive to learners' needs as they work with them, individually and in groups, and be able to ensure the positive and productive involvement of all as well as facilitate engagement when group work breaks down." Furthermore, educators "should also have techniques to guide (or redirect, as necessary) learners toward achieving the learning goal" (NAE, NRC, 2014).

STEM education provides students opportunities to learn through a variety of learning styles. Educators can help to foster these learning styles by using different teaching methods. "Teachers must adapt instruction to the students and reinforce learning through multiple teaching approaches" (Swift, Watkins, 2004). Brimmer further believes that "teachers that use multiple instruction strategies keep students engaged in the assignments" (2017). Students actively engage in STEM activities, as they participate in hands-on investigations, allowing students to think "outside of the box." "Elementary teachers need support to find ways to incorporate more hands-on, inquiry-based activities into the math and science curricula to assist in teaching the more abstract concepts" (DeJarnette, 2012).

Constraints

Educators constantly face a plethora of constraints when it comes to academics and meeting the overwhelmingly high-demands placed upon them. Elementary-level educators find it hard to become motivated to incorporate STEM into their classrooms due to constraints such as lack of time, lack of training, lack of self-efficacy, and lack of motivation. Gilles and Nichols (2014) state, "Less than one third of elementary teachers in the United States has efficacy in teaching science" (Bunn, 2015). Although a need exists for incorporating STEM in the classrooms, Nadelson et al. (2013) point out that "there are a variety of reasons why teachers are reluctant to do so, including the increased focus being placed on reading and math, as well as the lack of background knowledge, confidence, and self-efficacy" (Bunn, 2015).

Time presents a common battle with which educators wage continuously. Educators face a daunting task when finding the time to incorporate expected curriculum, develop students' social and emotional skills and foster positive relationships with students. At times, this task feels impossible.

> Teachers have an educational charge that includes balancing time among content area, meeting district and state mandates, developing lessons, and teaching to student diversity. Their lessons must engage students, relate to assessment, build on previous material, and prepare for future study. Lesson time constraints are about fifteen to twenty minutes which match the approximate attention span of K-4 students (Swift, Watkins, 2004).

To better manage time in the classroom, teachers tend to eliminate STEM curriculum from their instruction. "Teachers spend less time in science learning centers (tables or areas stocked with books and other materials that promote exploration) than in other learning centers, and they rarely offer science-related activities in any context, either planned or spontaneous" (Clements, Sarama, 2016). Further, "if science instruction does occur, it tends to consist of simple, isolated activities, giving young children little or no occasion to develop important experiential and skill bases for future science learning" (IOM, NRC, 2015). DeJarnette also worries that educators and students spend too much time focused on standardized testing. This loss of time can have a negative effect on students.

> The emphasis on standardized testing in America has hampered the growth of scientific pedagogy in the elementary schools to include inquiry-based projects. Elementary students often learn about scientific theory and the nature of science rather than doing scientific investigations for themselves. As a result, students are relying on the knowledge, products and conclusions of others rather than experiencing it for themselves. (DeJarnette, 2012)

Educators also confront a lack of training and/or experience with incorporating STEM into their classrooms. Current students possess "limited interest in STEM careers, particularly engineering, because they are not exposed to topics in [STEM] during their K–12 studies. Most

K–12 teachers have not been trained to integrate relevant STEM topics into their classroom teaching and curriculum materials" (Daugherty, et al., 2014). Many times educators lack "specific content knowledge in STEM areas and how to teach these concepts in a developmentally-appropriate manner...especially in adapting them to the youngest learners" (Weyer, 2018).

Unfortunately educators simply avoid teaching or placing STEM as a priority due to their own insecurities which, in turn, negatively affect their students.

> Children's dispositions to engage in STEM with confidence are often disrupted negatively by their parents' and teachers' own STEM anxiety. Teachers' and parents' lack of content knowledge and fear of STEM topics can result in avoidance of teaching, talking, and thinking about challenging STEM topics. (Spaepen, 2017)

Burton (2012) also agrees that educators' STEM insecurities will negatively impact their students. "Teachers who teach at the elementary level demonstrate mathematics anxiety themselves stemming from low SE [self-efficacy] for teaching mathematics. The anxiety carries over to their students, which leads to students feeling inept at math content and application" (Brimmer 2017). An adult's anxieties also affect a student's self-confidence. "Many parents and teachers experience anxiety, low self-confidence, and gendered assumptions about STEM topics, which can transfer to their children and students" (McClure, et al., 2017). Benuzzi additionally found there is a correlation between educators' feelings toward STEM and the amount of time they spend teaching STEM curriculum.

> Research has discovered that a teacher's attitudes and self-efficacy in teaching STEM subjects, specifically science, can affect how much time is actually spent teaching science: positive feelings lead to more time spent on science teaching, while negative feelings lead to less time spent on science teaching. (Sterling, 2006, as cited in Benuzzi, 2015)

Aside from educator-based constraints, constraints with the inclusion of STEM in education exist. Lantz found a "lack of a clear definition of what the implementation of STEM education should accomplish" (2009). Additionally, data shows an inequity in the availability of STEM opportunities in public education across the nation. According to the U.S. Department of Education's Office of Innovation and Improvement, "Presently, policies and practices that ensure equitable access to the best STEM teaching and learning are not widespread. States, districts, and schools struggle to provide all students with the STEM experiences required for the 21st century" (2016).

A final constraint that impacts both educators and students alike involves perceptions, cultural beliefs, and a "learned helplessness."

> One deeply embedded cultural belief in the United States is that math achievement largely depends on native aptitude or ability. In contrast, people in other countries, such as Japan, believe that achievement comes from effort. Research shows that the US belief hurts teachers and students and, furthermore, that it just isn't true. Students who believe—or are helped to understand— that they can learn if they work diligently will perform better throughout their school careers than students who believe that a person either gets it or doesn't. That view often leads to failure and what we call "learned helplessness." Similarly, students who have mastery-oriented goals (that is, students who try to learn and see that the point of school is to develop knowledge and skills) achieve more than students whose goals are directed toward high grades or outperforming others. (Clements, Sarama, 2016)

Educators and students need to learn and adopt the belief system that the Japanese culture has developed: both need to believe in themselves, see how their own personal achievement and effort are directly connected, and avoid falling into a "learned helplessness" trap.

Professional Development

Educators, like their students, are lifelong learners. Both continuously grow and learn. Through professional development, educators continue to mold themselves into the educators they would like to become. Professional development also provides an opportunity to alleviate some of the constraints facing educators.

As Bunn describes, "By providing teachers with professional development, it is believed that they will acquire the skills, knowledge, confidence, and efficacy necessary to effectively teach STEM topics in their classrooms" (Baxter, Ruzicka, Beghetto, Livelybrooks, 2014, as cited in Bunn, 2015). Professional development provides an opportunity for educators to learn from one another. "Research findings indicate that teacher collaboration and the development of professional learning communities will be important to effective integrated STEM education" (NAE and NRC, 2014).

One form of professional development is mentoring. Mentoring provides an opportunity for educators who do not have experience in STEM to learn from those who are trained and considered experts. As Jones et al. (2016) discovered, providing professional development in the form of mentoring is beneficial.

> Mentoring support given to teachers had a positive impact for both the teacher and the student in the following areas: instructional strategies, subject matter taught, using data to identify student needs, differentiating based upon individual student needs and characteristics, creating supportive, equitable classrooms where differences are valued, enlisting the help of family members, parents and/or guardians, working collaboratively with other teachers within the school building, connecting with key resource professionals, complying with policies and procedures, completing administrative paperwork, and providing emotional support. (Klar, 2018)

Mentor educators can lead their fellow educators in the hands-on learning of STEM. Afterall, very much like students, "when they [educators] feel intrinsic curiosity and joy about STEM in their own learning, and when their own instructors [mentors] demonstrate sensitivity to learning trajectories and best practices, teachers see a model they can use" (McClure, et al., 2017).

Not only do educators need exceptional professional development for a successful implementation of STEM, they also need the backing of their school administration.

“Teachers will need support from administrators as they struggle with the complexity and uncertainty of revising their teaching practice... including time for learning, shared lesson planning and review, and reflection…[as they] focus on deeper learning and effective transfer” (NRC, 2012).

Effort plays an essential role when learning something new. When learning and implementing new concepts, such as STEM, a growth mindset works best.

> We can help prepare adults to develop positive STEM mindsets in all children...through deliberate efforts to build teachers’ and parents’ confidence and competence in their own STEM abilities. Through helping adults change their attitudes, we will improve children’s confidence that they can become successful STEM learners (Spaepen, 2017).

CHAPTER III

SURVEY METHODOLOGY

Participants

The educator participants of this survey were nine kindergarten educators from the Mount Horeb Area School District in Mount Horeb, Wisconsin. Each of the educators instruct at the Early Learning Center. There were eight white female educators and one white male educator participating in this survey. The educators range from 5 – 31 years of teaching experience and range from 28 – 56 years of age.

Procedures

Consent was initially granted to perform the research on the educators at the Early Learning Center from Rachael Johnson, the school's administrator, using a consent form (Appendix C). I then introduced the participants to my study before the academic school year started in August of 2018. I described the purpose and significance of my study to the participants. The participants were then given a consent form for participation (Appendix B). After completing the consent form, the participants were asked to complete the "Educator STEM Survey" (Appendix A) based on their thoughts about STEM education. The participants were informed that the data that was collected for this study would be analyzed and presented only as group data. Below is a timeline of the procedures:

August 2018: I introduced the kindergarten educators to my research and study. I then had the participants complete the consent form for participation in my study and complete the pre-"Educator STEM Survey" based on their initial thoughts and feelings on STEM education.

August 2018: Professional Development: Next, I introduced the kindergarten educators to STEM. I first described what STEM was, the importance of implementing it, and how to successfully implement it in their classrooms. I provided a hands-on experience for each educator to participate in for the first STEM lesson (paper chain challenge) and went through the lesson with step-by-step directions and encouraged them to implement it into their classrooms. I offered assistance to each of the educators by volunteering to come into their classrooms to team-teach the lesson with them or to demonstrate how to successfully implement the STEM lesson.

September 2018: Professional Development: I provided each educator with a second STEM lesson (apple basket challenge) and provided a hands-on experience for each educator to participate in the second STEM lesson and went through the lesson with step-by-step directions and encouraged them to implement it into their classrooms. I offered assistance to each of the educators by volunteering to come into their classrooms to team-teach the lesson with them or to demonstrate how to successfully implement the STEM lesson.

October 2018: Professional Development: I provided each educator with a third STEM lesson (gourd basket challenge) and provided a hands-on experience for each educator to participate in the third STEM lesson and went through the lesson with step-by-step directions and encouraged them to implement it into their classrooms. I offered assistance to each of the educators by volunteering to come into their classrooms to team-teach the lesson with them or to demonstrate how to successfully implement the STEM lesson.

November 1, 2018: My kindergarten colleague Marcie Ingham and I developed, created, and offered a STEM night for educators, students, and families to attend and participate-in. We provided each kindergarten student from our two classes (37 kindergarten students) with directions for the three challenges as well as the supplies needed. The three challenges were as follows:

- **The Challenge: Baby Bear Boats**
    - The Mission: Mama and Papa Bear are stranded on a deserted island! Baby Bear (that's YOU) is on a mission to rescue them! Using the materials on the table, construct a "boat" that holds Baby Bear and floats on top of the water.
    - Test out your watercraft. Make repairs if needed.
    - When it floats, move on to the next challenge!
    - Don't forget to take your boat and bear with you!
- **The Challenge: Puppy Parachutes**
    - The Mission: The puppies are training to be performing parachutists for a competition but do not have working parachutes. Using the materials on the table, develop and create a functioning parachute so your puppy can land softly and safely on the target.
    - Test out your parachute. Make repairs if needed.
    - If your puppy lands softly and safely, move on to the next challenge!
    - Don't forget to take your parachute and puppy with you!
- **The Challenge: Marble Maze**

- The Mission: Mr. and Mrs. Marble love to roll through corn mazes in the fall. They love mazes SO much that they want to create one of their own. Using the materials on the table, create a marble maze with a START and FINISH so the marbles can test out their rolling skills!
- Test out your marble maze. Make repairs if needed.
- If you can move your marble from the start to the finish, move on to the next challenge!
- Don’t forget to take your marble and maze with you!

Between the two classrooms, we had a total of 22 out of 37 families attend the family STEM night (59.5% attendance rate). This consisted of 39 children and 34 adults total. We also had our district Superintendent, district Curriculum Director, building Principal, one school board member, four kindergarten educators (all involved with this study), two kindergarten paraprofessionals, and 8 student volunteers (6 high schoolers and 2 middle schoolers) attend our event.

November 2018: Professional Development: I provided each educator with a fourth STEM lesson (notecard chain challenge) and provided a hands-on experience for each educator to participate in the fourth STEM lesson and went through the lesson with step-by-step directions and encouraged them to implement it into their classrooms. I offered assistance to each of the educators by volunteering to come into their classrooms to team-teach the lesson with them or to demonstrate how to successfully implement the STEM lesson.

November 2018: Lastly, I had the educator participants complete the post-"Educator STEM Survey" based on their final thoughts and feelings on STEM education.

Instrumentation

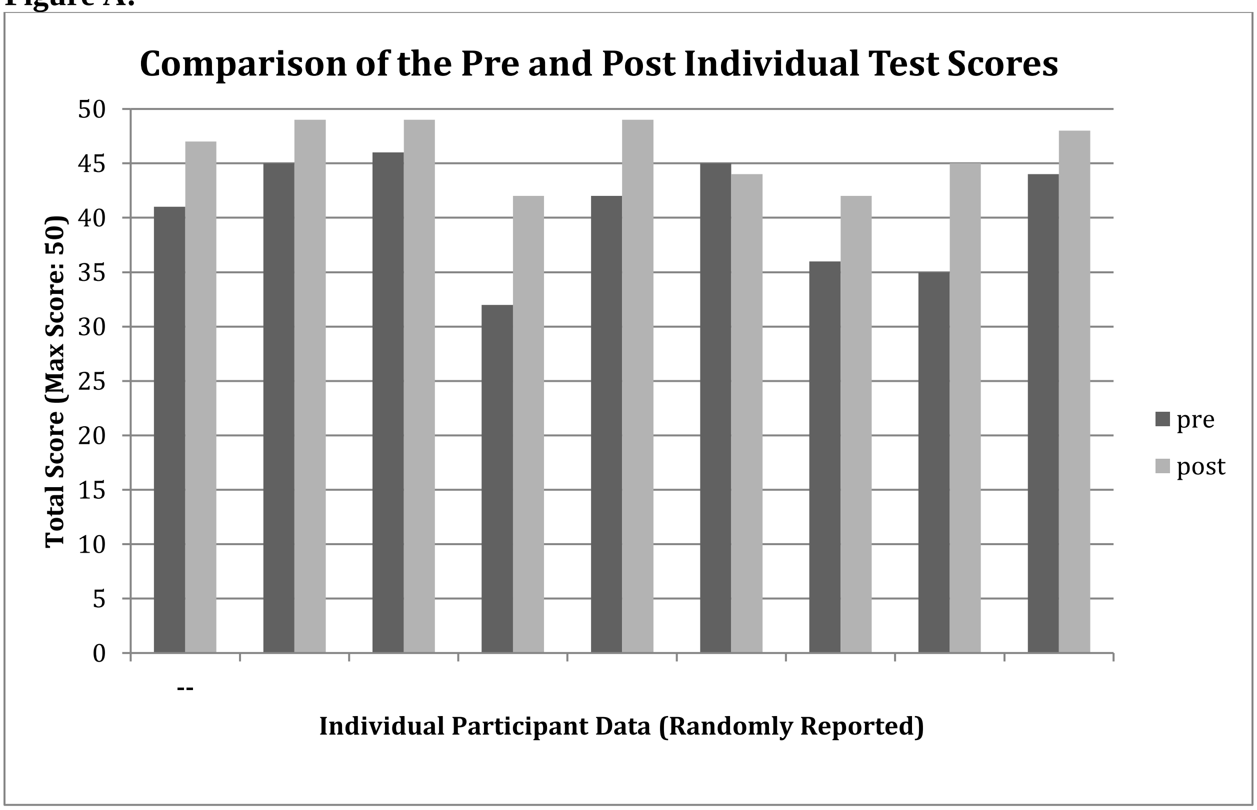
Each of the educator participants was given a survey entitled "Educator STEM Survey" (Appendix A). This survey was given before the school year began as a pre-test/survey in August of 2018 and again in the month of November (2018) as a post-test/survey. The survey was given anonymously to each educator by assigning a participant number. The survey included two demographic questions deciphering how many years the educator had been teaching and if they have had training in the implementation of STEM. If the educator had been trained in STEM, they were asked a follow-up question about how much training they had received reported by the number of years. The survey consisted of questions that focused on educator disposition and motivation toward STEM education.

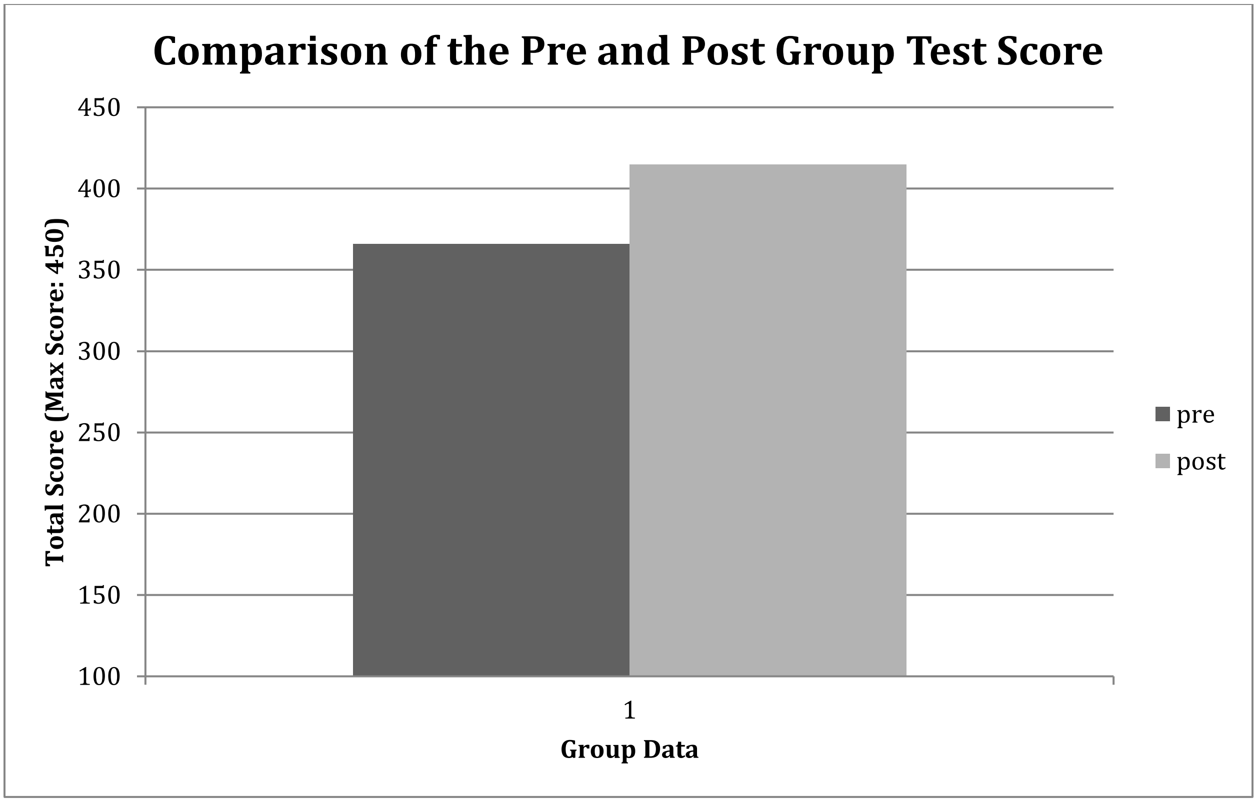
CHAPTER IV

ANALYSIS OF THE SURVEY DATA

After completing the data for both pre-test/survey and post-test/survey for the survey research, I used a hypothesis test to determine if I had meaningful results. I used paired data because I used a pre-test/survey and post-test/survey (surveying my colleagues twice.) I assigned each of the answers from the survey with a numerical point value (5 for strongly agree, 4 for agree, 3 for neutral, 2 for disagree, and 1 for strongly disagree.) After calculating my data, I put it into the formula created by Barbara Barnet (statistician, presently chair of the University of Wisconsin-Platteville Department of Mathematics) to show a comparison for the pre-test/survey and post-test/survey results (t-test). The comparison of the pre-test/survey data and post-test/survey data can be seen through the bar graph below (Figure A). The participant data is randomly reported on the graph due to my data being presented only as group data.

Figure A:





(Graphs created using Microsoft Excel spreadsheet.)

The P-value for testing post greater was 0.0008 which means the post value was significantly higher. The P-value for testing for a difference was 0.0015 which amounted to the means being significantly different. The mean difference from the data was -5.44444444. After analyzing the P-value, the data goes to show that there is evidence to reject the null hypothesis and show evidence to support my hypothesis of "provision of STEM learning opportunities in and out of the classroom will result in kindergarten educators improving their disposition and motivation toward including STEM investigations and curricula in their classroom communities."

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

After completing my research and analyzing my data, I was overwhelmed with happiness to see how much the disposition of the educators had drastically changed over the course of the three short months. With the start of any school year, many educators feel the stresses of the new year, getting to know new students and families, and learning new curriculum. I was initially very nervous to add one more new thing onto the educator's already full plates. Each of the participants was more than ready and willing to take on this new task with gusto. The data results from my research survey did show that there were positive advancements in the educator's dispositions towards the implementation of STEM after participating in numerous professional learning opportunities. What also impressed me were the countless positive conversations that ensued among colleagues throughout this entire process. The educator participants supported each other, encouraged one another, and ultimately made great connections with their students after implementing STEM lessons.

Throughout my study, the educators participated in multiple professional development opportunities that I provided. Each was involved with new learning opportunities to gain a better understanding about the importance of early STEM education. The educators also had the opportunity to attend an after-school STEM event to gain even more experience with STEM and to witness kindergarten students showing their STEM skills off to their families.

The improvements in the educator's dispositions that were involved with my study were incredibly inspiring to witness. The observations that I have made over the last three months of research have encouraged me to recommend that other educators learn more about STEM by attending professional development or to reach out to other educators that have had a successful experience with implementing STEM into their classrooms to gain insight and knowledge so that they too can improve their dispositions towards STEM education in the early years of education. The research and study I have conducted can be significant in that it can help increase the Mount Horeb Area School District's awareness of why including STEM in the early years of education is essential for both students and educators alike. This awareness could lead to future discussions and possible implementation of STEM education district-wide.

CHAPTER VI

REFERENCES

Basham, J.D., Marino, M. T. (2013). Understanding STEM Education and Supporting Students Through Universal Design for Learning. *TEACHING Exceptional Children*, 8-15.

Benuzzi, S. (2015). *Preparing future elementary teachers with a STEM-rich, clinical, co-teaching model of student teaching* (Doctoral dissertation). Retrieved from https://pqdtopen.proquest.com/doc/1697922575.html?FMT=ABS.

Brimmer, L.E. (2017). *Careers in STEM Begin with Elementary Student Interest in Mathematics.* (Doctoral Dissertation). Walden University.

Bunn, B. (2015). *THE IMPACT OF STEM PROFESSIONAL DEVELOPMENT ON EDUCATOR SELF-EFFICACY* (Masters seminar paper). Retrieved from MINDS@UWPlatteville: https://minds.wisconsin.edu/bitstream/handle/1793/76722/Bunn%2c%20Brenda.pdf?sequence=1

Clements, D. H., & Sarama, J. (2016). Math, Science, and Technology in the Early Grades. *Future of Children*, 75-94.

DeJarnette, N. K. (2012). America's children: Providing early exposure to STEM (science, technology, engineering and math) initiatives. *Education*, *133*(1), 77– 84.

Daugherty, Michael K.; Carter, Vinson; and Swagerty, Lindsey (2014) "Elementary STEM Education: The Future for Technology and Engineering Education?," Journal of STEM Teacher Education: Vol. 49: Iss. 1, Article 7. Available at: https://ir.library.illinoisstate.edu/jste/vol49/iss1/7

English, L. l. (2017). Advancing Elementary and Middle School STEM Education. *International Journal Of Science & Mathematics Education*, *15*5, 24.

Gerlach, J. (2012). *STEM: Defying a Simple Definition.* NSTA Reports. Retried from http://www.nsta.org/publications/news/story.aspx?id=59305.

Institute of Medicine (IOM) and National Research Council (NRC). 2015. Transforming the workforce for children birth through age 8: A unifying foundation. Washington, DC: The National Academies Press.

Klar, J. (2018). *Mentoring Teachers in STEAM Improves Likelihood of Application* (Masters seminar paper). Retrieved from MINDS@UW Platteville: https://minds.wisconsin.edu/bitstream/handle/1793/78582/KlarJackie.pdf?sequence=3.

Lantz, H. B., Jr., Ed.D. (2009). *Science, Technology, Engineering, and Mathematics (STEM) Education What Form? What Function?* Retrieved July 1, 2018, from https://dornsife.usc.edu/assets/sites/1/docs/jep/STEMEducationArticle.pdf

Marcum-Dietrich, N., Marquez, L., Gill, S. E., & Medved, C. (2011). No Teacher Left Inside: Preparing a New Generation of Teachers. *JOURNAL OF GEOSCIENCE EDUCATION*, 1-4.

McClure, E. R., Guernsey, L., Clements, D. H., Bales, S. N., Nichols, J., Kendall-Taylor, N., & Levine, M. H. (2017). *STEM starts early: Grounding science, technology, engineering, and math education in early childhood*. New York: The Joan Ganz Cooney Center at Sesame Workshop. Retrieved from http://joanganzcooneycenter.org/wp-content/uploads/2017/01/jgcc_stemstartsearly_final.pdf.

National Academy of Engineering and National Research Council. (2014). *STEM Integration in K-12 Education: Status, Prospects, and an Agenda for Research.* Washington, DC: The National Academies Press.

National Council for Accreditation of Teacher Education (2001). Professional standards for the accreditation of schools, colleges, and departments of education. Washington, DC: Author.

National Research Council. 2012. *Education for Life and Work: Developing Transferable Knowledge and Skills in the 21st Century*. Washington, DC: The National Academies Press. https://doi.org/10.17226/13398.

Robeck, E. (n.d.). *The NGSS and STEM Instruction: Two Intersecting Initiatives*. Retrieved July 8, 2018, from https://s3.amazonaws.com/ecommerce-prod.mheducation.com/unitas/school/explore/ngss/white-papers/ngss-and-stem-instruciton.pdf

Spaepen, E. (2017). *Early STEM Matters. Providing High-Quality STEM Experiences for All Young Learners.* A Policy Report by the Early Childhood STEM Working Group: https://d3lwefg3pyezlb.cloudfront.net/docs/Early_STEM_Matters_FINAL.pdf

Swift, T. & Watkins, S.E. (2004). *An engineering primer for outreach to K-4 education*. Journal of STEM Education, 5(3), 67-76. Retrieved June 24, 2018, from https://scholarsmine.mst.edu/cgi/viewcontent.cgi?article=1865&context=ele_comeng_facwork.

U.S. Department of Education, Office of Innovation and Improvement. (2016). S*TEM 2026: A Vision for Innovation in STEM Education.* Washington, DC: Author. Retrieved from: https://innovation.ed.gov/files/2016/09/AIR-STEM2026_Report_2016.pdf

Weyer, M. (2018, February 17). *EARLY STEM EDUCATION*. Retrieved from: http://www.ncsl.org/research/education/early-stem-education.aspx

APPENDIX A

Educator Survey

Educator STEM Survey

1. Participant Number:___________
2. How many years have you been teaching? ___________
3. Have you had training in implementation of STEM? (circle one): YES NO
4. If you answered YES for question 3, please circle one of the following for how much training you have received:
    1. Less than 1 year
    2. 1 - 2 years
    3. 3 - 4 years
    4. 5 - 6 years
    5. 7 years or more

For the following questions, please select one answer that best fits you at this current time:

5. I can define what STEM means.
    1. Strongly Agree
    2. Agree
    3. Neutral
    4. Disagree
    5. Strongly Disagree
6. I am comfortable with teaching STEM.
    1. Strongly Agree
    2. Agree
    3. Neutral
    4. Disagree
    5. Strongly Disagree
7. I am interested in STEM.
    1. Strongly Agree

    2. Agree
    3. Neutral
    4. Disagree
    5. Strongly Disagree

8. I think having STEM in schools is important.
    1. Strongly Agree
    2. Agree
    3. Neutral
    4. Disagree
    5. Strongly Disagree
9. I think having STEM in kindergarten is important.
    1. Strongly Agree
    2. Agree
    3. Neutral
    4. Disagree
    5. Strongly Disagree
10. I am motivated to include STEM in my classroom community.
    1. Strongly Agree
    2. Agree
    3. Neutral
    4. Disagree
    5. Strongly Disagree
11. I currently implement STEM lessons in my classroom community.
    1. Strongly Agree
    2. Agree
    3. Neutral
    4. Disagree
    5. Strongly Disagree
12. I have time to teach STEM.
    1. Strongly Agree
    2. Agree

3. Neutral
4. Disagree
5. Strongly Disagree

13. My administration is supportive of the inclusion of STEM in my classroom.
    1. Strongly Agree
    2. Agree
    3. Neutral
    4. Disagree
    5. Strongly Disagree

14. My students' excitement level is increased when they participate in STEM activities.
    1. Strongly Agree
    2. Agree
    3. Neutral
    4. Disagree
    5. Strongly Disagree

APPENDIX B

Consent Form for Educators

EDUCATOR CONSENT TO PARTICIPATE IN RESEARCH

The Inclusion of STEM in the Early Years of Education

You are asked to participate in a research study conducted by Kirk S. Nichols, from the department of graduate studies in education at the University of Wisconsin-Platteville. This study is being conducted as part of a graduate seminar paper/educational project. Your participation in this study is entirely voluntary. Please read the information below and ask questions about anything you do not understand, before deciding whether or not to participate.

PURPOSE OF THE STUDY

The purpose of this study is to identify the impact that providing Science, Technology, Engineering, and Mathematics (STEM) learning opportunities has on an educator's disposition and motivation.

PROCEDURES

If you volunteer to participate in this study, you will be asked to complete an "Educator STEM Survey". The questions will focus on your motivation and disposition toward STEM. Please be as honest as possible and answer all of the questions to the best of your knowledge. The data that is collected will be analyzed and presented only as group data.

POTENTIAL RISKS AND DISCOMFORTS

Your participation should present you with no risks, other than the time and effort involved in completing the survey and implementing STEM investigations in your classroom community.

POTENTIAL BENEFITS TO SUBJECTS AND/OR TO SOCIETY

Benefits from your participation in this study may include: an increased awareness of the impact and importance of implementing early STEM education, an increase in personal motivation and disposition toward STEM, and an increase in student excitement toward STEM education.

CONFIDENTIALITY

Confidentiality will be maintained by means of safeguarding your identity. A participant's name will be kept confidential. Instead, you will be assigned a participant number. Once the study is completed, a summary of the results will be made available through the Education Department office.

PARTICIPATION AND WITHDRAWAL

You can choose whether or not to be in this study. If you volunteer to be in this study, you may withdraw at any time without consequences of any kind or loss of benefits to which you are otherwise entitled. You may also refuse to answer any questions you do not want to answer. There is no penalty if you withdraw from the study.

PARTICIPATION QUESTIONS AND/OR CONCERNS

If you have any questions or concerns about your participation and/or treatment during this research, please contact Barb Barnet, Chair, UW-Platteville IRB at (608) 342-1942 or barnetb@uwplatt.edu.

If you have questions or concerns pertaining to the study, please contact the researcher, Kirk Nichols at (608) 437-7643 or nicholskirk@mhasd.k12.wi.us.

I understand the procedures described above. My questions have been answered to my satisfaction, and I agree to participate in this study.

____

Printed Name of Subject

____ __________________________

Signature of Subject Date

APPENDIX C

Consent Form for Administration

ADMINISTRATION CONSENT TO PARTICIPATE IN RESEARCH

The Inclusion of STEM in the Early Years of Education

You are being asked to allow participation in a research study conducted by Kirk S. Nichols, from the department of graduate studies in education at the University of Wisconsin-Platteville. This study is being conducted as part of a graduate seminar paper/educational project. Your participation is entirely voluntary. Please read the information below and ask questions about anything you do not understand, before deciding whether or not to participate.

PURPOSE OF THE STUDY

The purpose of this study is to identify the impact that providing Science, Technology, Engineering, and Mathematics (STEM) learning opportunities has on an educator's disposition and motivation.

PROCEDURES

Your approval will allow participants in this study to complete an "Educator STEM Survey". The questions will focus on an educator's motivation and disposition toward STEM. Your approval will allow educators to participate with the implementation of one STEM investigation in their classroom communities per month from August 2018 – November 2018.

POTENTIAL RISKS AND DISCOMFORTS

The participation should present participants with no risks, other than the time and effort involved in completing the survey and implementing STEM investigations in their classroom community.

POTENTIAL BENEFITS TO SUBJECTS AND/OR TO SOCIETY

Benefits from your participation in this study may include viewing an educator's increased awareness of the impact and importance of implementing early STEM education, an increase on an educator's personal motivation and disposition toward STEM, and an increase in student excitement toward STEM education.

CONFIDENTIALITY

Confidentiality will be maintained by means of safeguarding the participant's identity. A participant's name will be kept confidential. Instead, each participant will be assigned a participant number. Once the study is completed, a summary of the results will be made available through the Education Department office.

PARTICIPATION AND WITHDRAWAL

Participants can choose whether or not to be in this study. If a participant volunteers to be in this study, he/she may withdraw at any time without consequences of any kind or loss of benefits to which you are otherwise entitled. The participant may also refuse to answer any questions you do not want to answer. There is no penalty if he/she withdraws from the study.

IDENTIFICATION OF INVESTIGATORS
If you have any questions or concerns about this research, please contact Barb Barnet, Chair, UW-Platteville IRB at (608) 342-1942 or barnetb@uwplatt.edu.

I understand the procedures described above. My questions have been answered to my satisfaction, and I grant approval for this study to occur.

____

Printed Name of Subject

____ ____________________________

Signature of Subject Date