THE EFFECTS OF AN INTEGRATED CURRICULUM WITH EMBEDDED SUSTAINABILITY THEMES ON TEACHING AND LEARNING EXPERIENCES AT A PRIMARY SCHOOL

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ABSTRACT

THE EFFECTS OF AN INTEGRATED CURRICULUM WITH EMBEDDED SUSTAINABILITY THEMES ON TEACHING AND LEARNING EXPERIENCES AT A PRIMARY SCHOOL

Jeanne Marshall

The purpose of this case study is to investigate the effects of an integrated curriculum with embedded sustainability themes on teaching and learning experiences at the primary school level. The researcher examined why and how the district chose to create the integrated curriculum and how the big ideas of sustainability were embedded. Through the perspectives of teachers and administrators, the researcher analyzed how incorporating sustainability themes changed the teaching and learning culture. The transdisciplinary approach moves past the traditional boundaries of a discipline allowing curriculum to address real world problems. Using a transdisciplinary approach by integrating sustainability themes into the curriculum offered students high-level thinking learning experiences. The researcher conducted a case study of the district's integrated curriculum that incorporates sustainability at multiple schools. The participants in this study include administrators and teachers of students in kindergarten through sixth grade in a suburban school district. Virtual interviews with teachers and administrators and a virtual focus group were conducted. Documents were collected and analyzed. This study provides educators with a model of how schools can integrate sustainability themes

through an integrated curriculum. It offers an in-depth description of one school district's innovative approach.

Keywords: advocacy skills, primary school students, student leadership, sustainability, STEM programs, transdisciplinary approach

DEDICATION

I would like to dedicate this dissertation to all of the people that encouraged me and believed in me, even when I didn't believe in myself. First, thank you to my husband and children. You always made it possible and were very understanding when I needed to prioritize my studies over spending time with you. Now I'll always be available whether you like it or not. To my children, I hope my journey models for you that with hard work and persistence, you can achieve your goals. Thank you to my parents and sisters for being my inspiration. You made pursuing education and following my passion possible. Thank you to my co-workers, past and present, especially my carpool mates that acted as thought partners throughout this journey. Thank you to my former principal for seeing leadership qualities in me, for fostering them, and for always pushing me to be my best. You are a true role model to me and many others in the field of education. I am so lucky to have so many wonderful people in my life. Thank you for supporting me. I am so grateful for each and every one of you.

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CHAPTER 1

The effects of an integrated curriculum with embedded sustainability themes on teaching and learning experiences at a primary school.

Introduction

Albert Einstein said, "Education is not the learning of facts, but the training of the mind to think." The goal of education is to teach students how to think critically. To be leaders. To be prepared for the demands of future careers. Students must do more than memorize facts. They must learn how to question. Schools need to turn out students that are lifelong learners questioning the world around them and looking for ways to better society. It is the responsibility of educators starting at the primary school level to provide students with leadership and advocacy opportunities in order to develop the skills needed to meet the demands of the job market (Myers and Berkowicz, 2015). Students will need research and innovation skills to develop solutions to problems our world is currently facing and potential future problems. Additionally, students need to gain leadership skills. Education for sustainability may be a way of providing these skills for students.

There is a global climate crisis. Years ago, there was a controversy around what was causing global warming, whether it was the impact of human activity or natural earth cycles. Today, there is a broad consensus among scientists around Earth's changing climate which impacts us environmentally, socially, and economically (Bhattacharya, et al., 2021). It is now more urgent than ever to integrate the teaching of sustainability into elementary school curriculum. It is crucial for educators to provide opportunities for students to become aware of sustainability through learning about environmental protection and the climate crisis.

The STEM disciplines have a natural connection to the concepts of sustainability. The Next Generation Science Standards (NGSS) in elementary school address interdependent relationships in ecosystems, weather and climate, space systems, forces and interactions, energy, and Earth's systems (NGSS Lead States, 2013). Sustainability themes can be weaved into all of these science topics with a small amount of effort. Unfortunately, elementary school teachers often feel unprepared to address these topics (Daugherty, Carter, and Swagerty, 2014).

STEM education is the integration of science, technology, engineering, and mathematics. The teaching of these disciplines is not new, but the teaching technique of an interdisciplinary approach that incorporates an engineering design-based learning approach is fairly new (Havice, Havice, & Waugman, 2018). The Next Generation Science Standards (NGSS) were developed in 2013. In order to improve science and mathematics knowledge acquisition, the NGSS incorporated advocating for linking engineering and technology. Within the NGSS there are crosscutting concepts that "provide students with connections and intellectual tools that are related across the differing areas of disciplinary content and can enrich their application of practices and their understanding of core ideas" (NGSS Lead States, 2013).

According to DeJarnette (2012), there is an anticipated increase in STEM related jobs which requires there to be a change in the responsibility of schools to prepare students for the future job market. Unfortunately, due to high stakes testing, schools tend to spend more time on the core subjects including reading, writing, and mathematics (Daugherty, 2014). Since schools are not directly impacted by student performance of secondary curriculum subjects including science, technology, and engineering there is

less time dedicated to them. According to Daugherty (2014), the most critical time to provide opportunities for students to engage in integrated STEM education is at the elementary school level. By the time children are ten to fourteen years old their aspirations in STEM areas are largely formed and after that age, they vary little (Archer et al., 2012).

Elementary school is the time to create a foundation for students to become aware of their ability to make change and be advocates for what they believe in. We can't wait until students are older to integrate these important concepts. Prior research shows that there are more opportunities for students to learn about the climate crisis once they are in middle school and beyond (Bhattacharya, et al., 2021). Being more proactive about embedding sustainability concepts into the elementary school curriculum may provide advocacy opportunities for students.

Not everyone is leaving these children out. There have been some changes at the local level. The target of this study is special because it has designed its own integrated STEM curriculum. The Morris School District not only has an integrated STEM program, but it also embeds education for sustainability. According to Shelburne (2015), sustainability is "when the environmental, economic, and social needs are met in the present without compromising the ability for future generations to meet their needs." (p. 3). Teaching sustainability through science, technology, engineering, and math (STEM) programs offers opportunities for students to become active in their own learning. It allows students to identify problems facing our world. To develop solutions. To be change makers and problem solvers. It is teaching and learning two or more of the subject areas together (Sanders, 2008). Johnson, Peters-Burton, and Moore (2016) wrote,

"An integrated STEM approach is necessary for addressing global and local challenges, as well as for success in careers of today and those anticipated in the future" (p.4). Even though the fields of STEM are separate they are interdependent and related (Berube, 2014). STEM education is the integration of independent fields into one.

Providing sustainability themed advocacy opportunities for students in their school, their community, and the world allows them to see that the changes they make matter. Using the community in which students live or attend school as a resource makes learning more meaningful. Problem-based learning benefits STEM education because it allows students to solve problems themselves (Berube, 2014). Sustainability addresses economic, social, and ecological issues simultaneously. Incorporating sustainability can bring real-life problems into the classroom. Student learning becomes personalized through this transdisciplinary approach (Clark & Button, 2011). They begin to look at the world differently, they become more passionate about what they believe in, and they become problem solvers and critical thinkers. Education for sustainability is incorporating the issues of sustainability into the field of education (Caiman & Lundegard, 2018). Bringing STEM education and education for sustainability together creates a transdisciplinary approach that may offer students leadership opportunities.

Purpose of the Study

The purpose of this case study is to fill a gap in the research around education for sustainability at the elementary school level. There is previous research around integrating environmental education into STEM programs, but the research focuses mainly on middle and high school curriculum. This study investigates if and how embedding sustainability in primary school STEM programs through an integrated

curriculum could offer leadership and advocacy opportunities for students. In particular, the researcher examined what sustainability themes educators incorporate into the STEM programs and integrated curriculum. The researcher examined through the perspectives of teachers and administrators if and how the district's teaching and learning culture changed with the implementation having sustainability embedded into the integrated curriculum. The researcher analyzed if and how the students engaged in this new type of learning opportunity and developed their social emotional and advocacy opportunities. This case study investigated if offering sustainability themed units at the primary school level can offer students a chance to engage in real life learning. It investigates the outcomes of student leadership opportunities when sustainability themes are incorporated into STEM programs through a deep dive of the districts integrated curriculum. The researcher analyzed how a sustainability themed curriculum provides opportunities for students to contribute as leaders and advocates.

This study helps to fill a gap in the research by providing a model for other elementary school teachers and administrators. Research shows that often elementary school teachers have low self-efficacy in their ability to teach STEM (Rittmayer & Beier, 2008). This study will present the perspectives of educators, their experiences, and how they were able to embed education for sustainability into their integrated curriculum which then will give insight for others to make improvements to their own practice. According to Daugherty, Carter, and Swagerty (2014), "Most K–12 teachers have not been trained to integrate relevant STEM topics into their classroom teaching and curriculum materials." (pg. 48). This study shares that even teachers apprehensive about teaching sustainability themed lessons, once embedding the content into their curriculum,

they are able to do it without being overwhelmed and they acknowledged the benefits of doing it.

The rationale for this study is to provide educators with a description and model of how sustainability themed units can be integrated into the curriculum in primary school settings. Sustainability themed curriculum may facilitate leadership opportunities for students. This study will provide a model for how this can be done in other schools.

Theoretical Framework

This study is based on a theoretical framework that demonstrates the transdisciplinary approach by teaching sustainability through elementary school STEM programs. A transdisciplinary approach is a holistic approach that connects multiple disciplines. According to Nicolescu (2014), "transdisciplinary concerns that which is at once between the disciplines, across the different disciplines, and beyond the disciplines. Its goal is the understanding of the present world…" (p.187). Integrating the big ideas of sustainability into STEM classes, students are provided with opportunities for student leadership and advocacy. (See Figure 1) As shown in figure 1, the teacher provides a transdisciplinary approach to education by transcending multiple subject areas and embedding education for sustainability holistically through an integrated curriculum. The students are engaged in real world learning opportunities. Sustainability themes are integrated into the curriculum which could lead to student leadership and advocacy opportunities.

Significance and Importance of the Study

This study shows at a primary school level, students are able to be leaders, have voice, make decisions, and take action when engaged in education for sustainability.

Moye, Dugger, and Starkweather (2014) said, “Possessing knowledge is very important. However, being able to draw upon and apply that knowledge is necessary to adequately function in life and the reason why learning is so important.” (p. 22). This is critical to further understand how STEM education and sustainability can provide opportunities for students to apply knowledge through advocacy. 58% of all new jobs require STEM skills (Banerjee, 2017). STEM education must include the major problems facing the globe in terms of sustainability (Rogers, et al., 2015). Finding solutions to global challenges requires STEM concepts and interdisciplinary thinking (Asunda &Weitlauf, 2018).

The climate crisis our world is facing makes this topic important to study. This study shows through detailed description how one district successfully integrates sustainability into their elementary school STEM program and through the district’s integrated curriculum to offer leadership opportunities for their students. The case in this study may serve as a model for other school districts to demonstrate the benefits that incorporating sustainability can have on a school’s teaching and learning culture. Due to the global climate crisis, there is a need to develop an understanding of the phenomenon of global climate change. Based on a study done by Bhattacharya, Carroll Steward, & Forbes (2021), teachers feel under prepared in their science content knowledge when teaching about climate change and consider teaching about it a low priority. The Next Generation Science Standards don’t place an emphasis on the Earth’s climate until the sixth-grade standards. There is a need to lay a foundation for younger students so they can become more aware of the human impact on the earth. This study will serve as an example of how to embed sustainability into the lower grades in a way that teachers feel comfortable doing it.

Social Justice and Vincentian Mission

This study is aligned to social justice and the Vincentian mission because it strives to enhance educational and advocacy opportunities for all students by identifying strategies that work to provide student leadership opportunities. By incorporating sustainability in primary school STEM programs students learn about equity and improving the human experience for all. Through incorporating sustainability into the curriculum students are provided with opportunities to be advocates for change and they become innovative, lifelong learners prepared for future careers. Education for sustainability offers students opportunities to search out the causes of social injustice and creates advocacy opportunities to fight for those injustices.

Research Design

This study is a qualitative case study analysis of primary school teachers and administrators' perceptions towards embedding sustainability into the district created integrated curriculum. The study was conducted in a suburban New York school district during the 2021- 2022 school year, three years after first implementing the new integrated curriculum. It is a diverse school district. One third of the school district is considered economically disadvantaged. Half of the student population is white, thirty percent is Hispanic, thirteen percent Asian, and the other four percent is black or multiracial. The qualitative data was collected through fifteen virtual interviews including four administrators and eleven teachers, a focus group of four teachers, and content analysis of documents related to education for sustainability and the integrated curriculum. The qualitative data was stored on a password protected computer and was analyzed with the assistance of the computer program ATLAS. Analytical spirals were used when

reviewing the data. Coding and memoing were used to determine the themes and subthemes. The data collected was used to develop a deeper understanding and conceptualization of the research topic and question.

Purposeful sampling and snowball sampling were used to identify participants for the study. The participants included teachers and administrators. They had a range of education, from bachelor to doctorate degrees with varied years of experience ranging from four to thirty-six years. The teachers included STEM and classroom teachers. The focus group consisted of four third grade teachers. They are the teachers of the dual language program, two teaching the English side and two on the Spanish side. The varied participant positions and level of experience provided a range of perspectives. The research continued until the data became saturated.

Research Questions

1. What processes are useful for embedding sustainability into an integrated curriculum?
2. How is a sustainability themed curriculum implemented?
3. How has the implementation of a sustainability themed curriculum changed the school's teaching and learning culture?

Definition of Terms

Advocacy skills. Students having the ability to fight for change to improve their community and the world around them, particularly promoting causes around sustainable environmental protection.

Primary school students. The education of school children in kindergarten through sixth grade.

Student leadership. Influencing others to achieve a common goal; Taking ownership of your learning; modeling leadership skills such as problem-solving, working in teams, resolving conflicts, appreciating people's differences, making contributions to the community, and feeling a sense of purpose.

Sustainability. Through environmental science, technology, engineering, and mathematics education, bringing awareness to the goals of economic prosperity, environmental integrity, and social equity. Having students gain understanding of the importance of protecting the Earth and Earth's systems. Working to meet the needs of the present without compromising the ability of future generations to meet their own needs (World Commission on Environment and Development, 1987).

STEM programs. In elementary school, integrating the content areas of science, technology, engineering, and mathematics into one program. Through this integration, creating a systematic shift of how learning happens. Not just the teaching of the subjects but includes the learning processes of inquiry, imagination, questioning, problem solving, creativity, invention, and collaboration (Myers and Berkowicz, 2015).

Transdisciplinary approach. An approach to curriculum integration which dissolves the boundaries between the conventional disciplines and organizes teaching and learning around the construction of meaning in the context of real-world problems or themes (IBEU, 2016).

CHAPTER 2

Introduction

The primary objective of this chapter is to provide a comprehensive understanding of the conceptual framework that underpins the entire study, shedding light on the crucial link between the transdisciplinary approach and education for sustainability. The synthesis of these two key concepts is pivotal in facilitating student learning and engagement in STEM education. By promoting critical thinking, problem-solving, and collaboration across diverse disciplines, the transdisciplinary approach empowers students to become proactive agents of change in their communities and beyond. It fosters a sense of responsibility and agency, encouraging students to engage in issues related to sustainability, advocate for positive change, and take leadership roles in promoting sustainable practices. To provide context and grounding for this discussion, this chapter presents a review and synthesis of existing research in four key areas: the transdisciplinary approach, education for sustainability, student leadership, and integrated curriculums. Key studies, theoretical models, and empirical evidence that have contributed to the development and understanding of these concepts will be explored in this literature review within the context of practical applications in STEM education for young students.

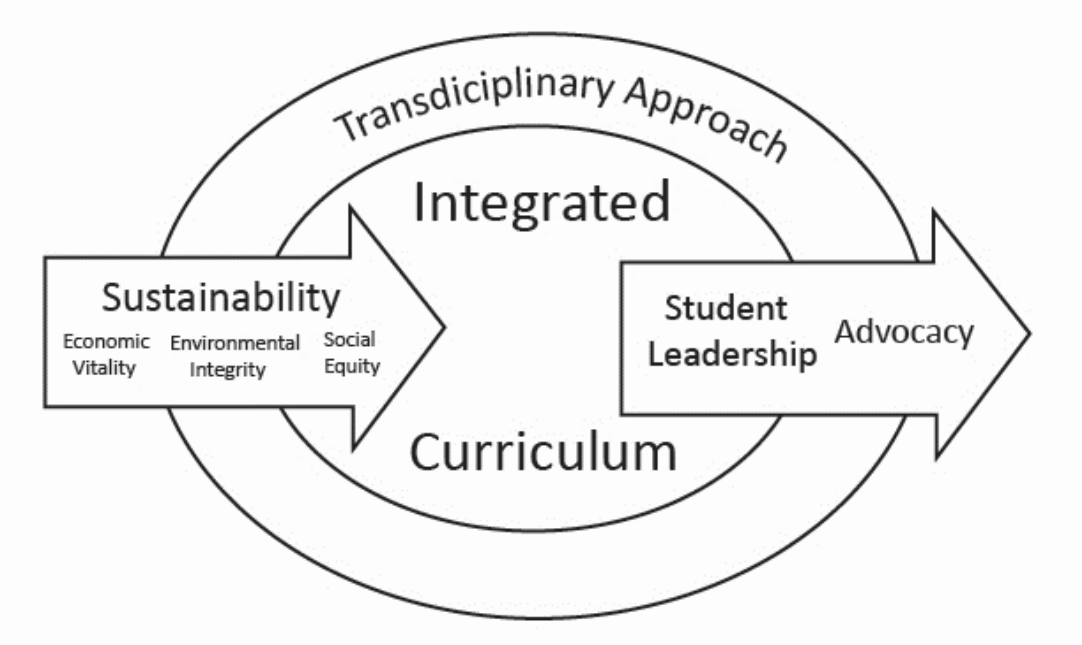
Theoretical Framework

This study is based on a theoretical framework linking the transdisciplinary approach of teaching (Piaget, 1972) with the big ideas of sustainability through STEM education (Shelbourne, 2015). By combining these ideas, the teaching and learning culture shifts from being teacher directed where students are more passive to student

centered where they take on an active role in their learning. This provides students with opportunities for student leadership and advocacy through real world problem solving (see Figure 1). Students are given opportunities to construct their own knowledge.

Figure 1

Theoretical Framework



A transdisciplinary approach is used to address complex modern problems that in addition to being multidisciplinary and interdisciplinary, transcend multiple disciplines by incorporating non-academics. This connects to teaching sustainability through STEM education because the disciplines of STEM are academic and can be related to the domains of sustainability, including non-academic areas that affect our world.

Transdisciplinary learning weaves academic disciplines together with real-world concepts and challenges. It empowers students to intertwine their personal interests and harness their existing knowledge within the framework of academic subjects. This approach encourages students to form intricate connections by extending their learning

beyond the boundaries of individual disciplines. Through transdisciplinary learning, students acquire the ability to creatively address genuine issues using multiple perspectives and innovative problem-solving techniques. Students are able to link their interests and apply their prior knowledge with academic disciplines.

STEM education provides opportunities for authentic tasks. By integrating education for sustainability, complex real-world problems transcend across multiple disciplines and non-academic areas. Research in the field of sustainable science is inherently transdisciplinary because of its interactions across domains. Issues around sustainability combine ecological and social components and overlap many disciplines (Stock & Burton, 2011).

Transdisciplinary Approach

The term transdisciplinarity was first introduced by Jean Piaget at a seminar in 1970. Piaget (1972), referred to it as a "higher stage succeeding interdisciplinary relationships… which would not only cover interactions or reciprocities… but would place these relationships within a total system without any firm boundaries between disciplines" (p.138). Basarab Nicolescu has done extensive work around transdisciplinarity. He explains that the transdisciplinary approach transcends the disciplines and incorporates the problems that plague humanity (Nicolescu, 2014). This is why embedding sustainability into STEM education is an example of the transdisciplinary approach. It goes beyond the disciples of STEM education and looks at problems affecting our global society.

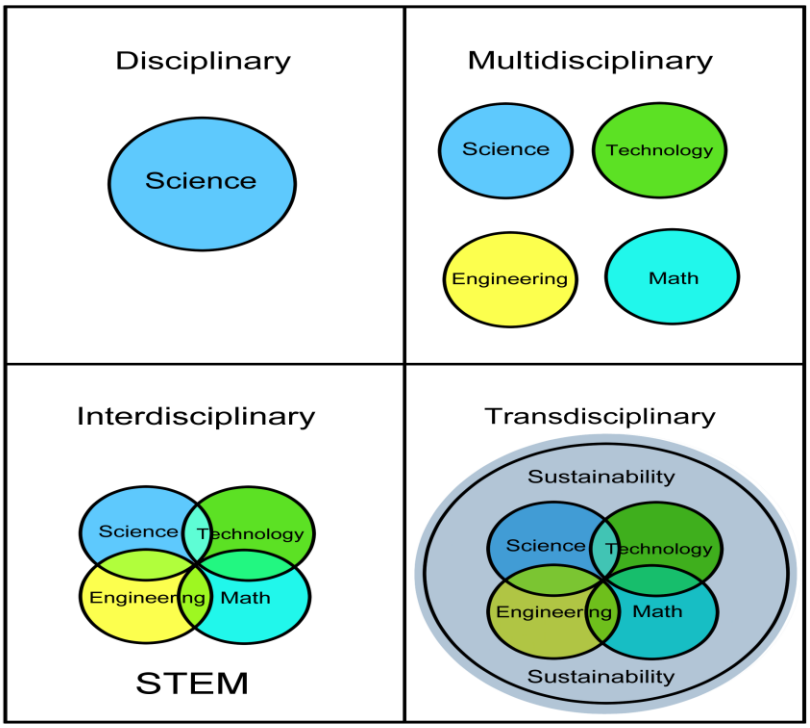
The transdisciplinary approach is a holistic way of connecting multiple disciplines into a learning experience that focuses on real-world problems. A discipline is one

branch of knowledge or instruction (Alvargonzalez, 2011). Multidisciplinary refers to a topic that can be taught in more than one discipline, for example a painting by Giotto could be analyzed in art history class or history of religion (Choi & Pak, 2006). Interdisciplinary synthesizes more than one discipline which could generate new disciplines, for example, the synthesis of art and technology creating the disciple of graphic design. The transdisciplinary approach takes it one step further by combining multiple disciplines and everything that occurs between them and beyond them (Alvargonzalez, 2011). (See Figure 2) Incorporating sustainability into STEM programs creates a transdisciplinary approach because it is taking into account the diversity of real-world problems linking the abstract with specific knowledge (Alvargonzalez, 2011). Education for sustainability creates opportunities for complex thinking and problem solving for the common good.

In the past, students were expected to be receivers of knowledge that could correctly answer the teacher's questions. Now, students are required to have higher level thinking skills; being able to address complex transdisciplinary issues (Sias, et el., 2017). The transdisciplinary approach of incorporating sustainability through STEM education has students simultaneously working in multiple academic areas while solving bigger problems that transcend traditional disciplines. It allows students to take action by imagining the possibilities out there (Clark and Button, 2011). Combining the transdisciplinary approach and education for sustainability allows students to be engaged with a holistic curriculum with authentic learning experiences. Providing real world problems for students to engage with can create opportunities for students to advocate for change they believe in.

Figure 2

Illustration of the Transdisciplinary Approach Going Beyond a Single Discipline



Adapted from Marini & Volk, 2017

According to Brown et al. (1989), "Too often the practices of contemporary schooling deny students the chance to engage the relevant domain culture…" (p.34). This means, schools need to provide authentic learning situations for students to be able to gain and transfer knowledge. Authentic activities are ordinary practices of the culture. This can be done in the school setting by providing authentic problem solving, learning while in service, through projects, and simulated situations (Díaz Barriga, 2013).

According to Hung (2004), "schools should foster opportunities for learners to experience phenomena by doing; triggering learners to make meaningful observations…" (p.198). Through the transdisciplinary approach, curriculum is designed to allow for

students to think creatively and work collectively on projects (Nordén, 2018). Since knowledge is gained through activity, incorporating sustainability may provide students with real world situations leading to opportunities for their learning.

According to Hung (2002), "learning or understanding always takes place in a problem situation or authentic context." (p.402). STEM programs that integrate education for sustainability are designed to offer students learning experiences that include discussion, sharing knowledge, problem solving, and advocacy in an authentic context. According to Brown, Collins, and Duguid (1989), "Knowing and doing are interlocked and inseparable." (p.35). Through activity, concepts develop. Knowledge if formed by actions that are bound to social, cultural, and physical contexts (Brown, et al., 1989). Sustainability themed STEM tasks provide the learner authentic opportunities to engage in a holistic experience.

STEM programs that integrate sustainability can naturally be project-based and can provide opportunities for students to actively participate in their learning. Students solve problems. They collaborate. They advocate. Situations for cognition are provided through the integration of sustainability through the STEM classroom by the authentic nature of the discipline.

STEM classes that have sustainability embedded into the curriculum can provide opportunities for students to advocate for change. The following is an example of how the transdisciplinary approach can provide leadership and advocacy opportunities. Students conduct sustainability audits at different levels, at school, home, in the local community, and the world. They could focus on water, waste, or energy consumption. Conducting the audit encompasses the disciplines of science and math. They identify

problems that they are interested in advocating for and then design solutions. This brings in the engineering and technology component. They become the agents of change. This unit incorporates the STEM disciplines but goes beyond the disciplines by encompassing sustainability themes in an authentic setting. Education for Sustainability naturally transcends disciplines because of its complex nature. Addressing environmental problems breaks the traditional boundaries of a discipline or multidiscipline. The students engineer solutions to these real-world problems. They become leaders and advocates for the problems they have identified.

Combining the transdisciplinary approach and sustainability themes into the STEM curriculum, students may have opportunities that allow them to take on leadership roles. Through the transdisciplinary approach students are active participants in their learning. According to Doddington (2014), "concerns introduced should be real and puzzles should be genuine if children are to authentically invest themselves…" (p.1264). In order to be educational, experiences must be personal and meaningful. This is what embedding sustainability can provide for the students.

Review of Literature

The following previous research about Education for Sustainability, student leadership, and integrated curriculum provide us with incite on how these topics may be used to benefit student learning (Shelbourne, 2015). Through the use of an integrated curriculum, Education for Sustainability may be a way of providing leadership opportunities for students. The Next Generation Science Standards (NGSS) and the Framework for K-12 Science Education (National Research Council, 2012) have made an effort to reform the science standards to include sustainability. This was done by adding

systems thinking to the Earth and Space standards to include how Earth processes impact humans and how human activity impacts the Earth (Egger, Kastens, & Turrin, 2017). Embedding sustainability initiatives into STEM education programs provide students with opportunities to collaborate with other students, to ask questions, and solve real-world problems (Rogers, et al, 2015). Students follow the design process to identify problems, design solutions, and test and evaluate them. Through participating in STEM classes students are developing higher-order thinking skills which will better prepare them for their future careers.

Education for Sustainability

Defined by the World Commission on Environment and Development (1987), sustainability is "working to meet the needs of the present without compromising the ability of future generations to meet their own needs." Sustainability is improving the quality of life for all, by encompassing the goals of economic prosperity, environmental integrity, and social equity (Shelbourne, 2015). As shown in Figure 3, Educating for Sustainability (EFS) is a way of looking at the curriculum through a lens of sustainability to interweave its themes through other disciplines.

EFS allows students to examine real-world questions on any topic and provides hands-on activities for actual situations. EFS's big ideas of sustainability are in Figure 3. The "Big Ideas of Sustainability" can be applied to all disciplines. In this study, the focus is STEM and EFS through the district's integrated curriculum topics. The "Big Ideas of Sustainability" were used throughout this study to identify sustainability themes in the district's curriculum. Once identified, the researcher then determined the impact they had

on student learning. According to Shelburne (2015), there are three parts that come together which allow citizens to be engaged in creating a sustainable community.

Figure 3

The Big Ideas of Sustainability

(Shelburne, 2015)

First there has to be knowledge that humans and the natural world are connected. Next is having an understanding that the world is interconnected. Finally, there has to be a knowledge that we can make a difference (see Figure 4).

Figure 4

Interconnecting of Knowledge and Understanding to be Engaged in Sustainability

(Shelburne, 2015)

The field of environmental education is not new, but it has evolved over the past century. In 1977 objectives for environmental education were developed at the Tbilisi Intergovernmental Conference on Environmental Education (Hungerford & Volk, 1990). These objectives include awareness, sensitivity, attitudes, skills, and participation. With traditional thinking it is believed that to change human behavior, an increase in knowledge of the problem is needed. An increase in knowledge leads to favorable attitudes which in turn motivates behavioral changes. According to Hungerford and Volk (1990), when knowledge and skills are focused on a specific issue there can be improvement, but students don't have the knowledge, skills, and willingness to assume

environmental responsibility in their everyday lives. Unfortunately, the evidence is not showing that traditional thinking will lead to broader behavioral changes. Students need to go beyond awareness and knowledge and need to take ownership and be empowered to become active citizens in order to make real change.

More recently, due to the effects of global warming and the awareness of the issues of global sustainability there is more urgency and agreement around the need for change in behaviors and an integration of sustainability practices to be taught in school. Unfortunately, there are many problems that limit the amount of environmental education that is being implemented in schools, especially at an elementary school level. According to Knapp, Volk, and Hungerford (1997), environmental education and environmental interpretation are closely related. They stated "Interpretation addressed to children should not be a dilution of the presentation to adults but should follow a fundamentally different approach. A separate program is needed so that presentations can best be shown to children." The goals for environmental education curriculum development are hierarchical and culminate in responsible citizen behavior (see Figure 5) (Knapp et el. 1997). Some of the desired environmental behaviors include community participation, resource preservation, and energy conservation. There is entry- level that involves ecology knowledge and environmental sensitivity. The next level is ownership which includes an in-depth knowledge of the issues and a personal investment in the issues and the environment. The third level is empowerment. At this level you have the knowledge and skills to use environmental action strategies. The final level is citizenship behavior which can cause change in the knowledge, attitudes, and behavior of citizens. These levels are necessary to promote and understanding of environmental education.

Figure 5

Goals for Environmental Education

Incorporating sustainability themes is relevant to the disciplines of STEM education (Hopkinson & James, 2010). According to Rogers, Pfaff, Hamilton, and Erkan (2015), "traditional STEM education must expand to include an awareness of a new class of problems with sustainability as a unified theme" (p. 524). Embedding the themes of sustainability increases student awareness about the potential impact they have on the planet. Slight changes to current curricula, bringing in environmental and social issues can make significant differences to student awareness (Rogers et al., 2015). For example, a classroom activity about energy could go a step further to the impacts of fossil fuels.

Which could lead to learning about climate change. This could provide students an opportunity to take action, teaching others about lifestyle choices that impact the health of our Earth. Students can analyze their own household's energy consumption and determine ways to reduce their carbon footprint.

Providing problem-based learning and incorporating real world problems for students to engineer solutions provides more meaningful learning opportunities for them. Lessons that are designed to be student centered and encouraging teamwork help promote student leadership and advocacy opportunities. Having a holistic approach by combining the content disciplines with sustainability, motivates students to take a greater responsibility for their own learning and make environmental improvements (Hopkinson & James, 2010).

Effects of Environmental Education Professional Development. Green and Somerville (2015), conducted a longitudinal participatory action research study of 16 in-service teachers and five principals from a mix of eight large and small regional schools in south-eastern Victoria, Australia. Principals identified mentor teachers for the pre-service teachers' three-week practicum placement. They were placed in groups to promote cross-classroom sustainability collaborations. In contrary to other studies that identify teacher's personal knowledge and understanding of environmental issues as inhibiting factors for teaching sustainability, the teachers in the study shared a common interest in environmental and sustainability education. They were motivated to expand sustainability discourses and practices in their respective schools. They were often leaders in developing whole school sustainability policies. The researchers conducted semi-structured focus groups with teachers and principals. They were designed to bring

teams together to share their understanding, interpretation, and practices of sustainability across their respective schools.

In the first year of the study, two teacher educators researched the practice of integrating sustainability into teacher education. In the second year, the researchers partnered with the deputy principal, a lead teacher and two 3rd and 4th grade teachers to trial a process for the integration of sustainability into teacher education and teacher professional learning. Additionally, the researchers observed that the pre-service teachers often experienced resistance to their new learning during placement, reinforcing their own anxieties in relation to sustainability education. The third year of the study was to understand how to connect individual local sustainability initiatives by creating a mapping system to gain further insight of the sustainability needs across the region to gain greater transformational change.

Many teachers showed interest in incorporating sustainability into the curriculum but are hesitant for a two main reasons: they do not believe they have a strong understanding of the concepts, or they feel they don't have time in the year to add anything to the already full curriculum (Green & Somerville, 2015). Sustainability themes are transdisciplinary and can be incorporated throughout any curriculum through an integrated approach.

According to Boeve-de Pauw, Olsson, Berglund, and Gericke (2022), Education for Sustainability empowers learners to take responsible action and make informed decisions around environmental integrity, economic vitality, and create a just society for present and future generations. Education for sustainability promotes critical thinking, decision- making, and empowers students. The complex interconnectedness of the issues

around sustainability requires interdisciplinary expertise. Teachers often feel unprepared to apply the educational principles and goals around sustainability due to this complexity (Boeve-de Pauw et al. 2022). In addition to teachers having a low self-efficacy when it comes to education for sustainability, there is a lack of professional development around it.

Jelle Boeve-de Pauw, Daniel Olsson, Teresa Berglund & Niklas Gericke (2022), conducted a longitudinal quantitative study investigating teachers' development of self-efficacy and teaching practices relating to education for sustainable development. They studied four compulsory schools in a Swedish municipality. The teachers participated in a professional development program over three school years designed to support them in implementing education for sustainable development. Between and after the seminars online survey data was collected to monitor changes that occurred across a timeframe of three school years. There was a total of 414 data entries using a 12-item 5-point Likert scale tapping into teachers' self-perceived pedagogical content knowledge. The mean age of the survey respondents is 30.5 years and 75% of respondents are women.

The results of the study show increased mean values for all the items as the teachers progress through the professional development program. The areas that teachers perceived as difficult or experienced at a low or only moderate level of competency are dealing with the economic, political, and international aspects of Education for Sustainability. Teachers reported low mean values relating to incorporating collaboration with diverse societal actors, using the outdoor natural environment, and connecting economic, social, and environmental aspects within the context of Education for Sustainability. The areas the teachers had high self-efficacy relate to defining

educational objectives and connecting Education for Sustainability to the curriculum and applying a multidisciplinary approach. Additionally, there is a high mean value related to including diverse viewpoints in the classroom as well as encouraging students to identify their own opinions. The teachers reported that they use a diversity of teaching approaches. In addition to the lack of professional development around education for sustainability, there are other barriers that have been identified.

Barriers to Education for Sustainability. As per the findings of a Q methodology research study conducted by Anderson and Jacobson (2018) in Ecuador, teachers encountered several obstacles while endeavoring to implement environmental education. These barriers encompassed constraints related to time, financial resources, availability of instructional materials, access to relevant training, and proficiency in the subject matter. They conducted a global literature review analyzed peer reviewed journal articles with empirical results published between 1988 and 2016 with keywords barriers, environmental education, and teachers. They used the 48 barriers that were identified across the studies and created Q sets or sets of statements about a topic. The 25, grade 1-7 teacher participants then organize the statements based on their beliefs. Ultimately leading to their findings.

Educators feel generally well prepared to teach other subject matter from their pre-service programs but not around sustainability (Boeve-de Pauw et al. 2022). The most common obstacle that teachers identified was lacking examples of how to teach education for sustainability and that they lacked the expertise. Education for sustainability professional development programs have made an effort to improve this by

implementing and evaluating long-term, intensive, real-world, hands-on, team oriented professional development (Boeve-de Pauw et al. 2022).

Benefits of Education for Sustainability. To make learning meaningful and effective, students need to be involved in the experience of doing. They need to be made aware of the environmental impact of the everyday choices they make. Through sustainable education, students work together to solve complex problems through the interdisciplinary approach (Rogers, et al, 2015). Clark and Button (2010) claim, providing transdisciplinary learning experiences and incorporating sustainability can cause the heart and mind to naturally question daily-life choices that promote cultural change.

Bringing students outside the classroom helps to motivate learners. Some educators feel that high-stakes testing limits the amount of time for place-based learning or teaching in informal settings (Moye, Dugger, & Starkweather, 2014). These settings such as school gardens and areas in the local community provide ideal sustainability themed learning opportunities. A pilot study of a garden-based curriculum was done by Fisher-Maltese, Fisher, & Ray (2018). The study included kindergarten through fifth grade elementary schools in Ward 8, Washington D.C., the poorest part of the city. The school is a low performing school in which 73% of students were below proficiency in math and 80% were below proficiency in reading. The program was analyzed to determine how school garden programs provide learning opportunities, produce more environmentally literate students, and how citywide, schoolwide garden programs contribute to the city's sustainability efforts. Data was collected through participant observations and pre and post assessments. Although there was a small sample of only

n=10, completing both the pre and post survey, they found that environmental attitudes did go up and students' engagement and enthusiasm seemed to increase as a result of the garden lessons.

It is especially important to provide environmental sustainability opportunities through community gardens for urban, low-income, and minority students because without these opportunities created in school, they may not be exposed to experiences that promote environmental awareness (Maltese, Fisher, & Ray, 2018). These informal settings enhance learner-motivation, interest, contextual relevance, collaboration, and open-ended thinking opportunities that improve students' science literacy and bring awareness to serious environmental issues. Using the school grounds and local places in the community causes students to feel responsible and be connected to their world. Students move beyond the classroom to pose questions and inquire about solutions (Green & Somerville, 2015). Informal settings provide situations for students to apply their learning in a natural way. Environmental settings allow students to view themselves as scientists (Maltese, Fisher, & Ray, 2018). These provide authentic learning experiences for students.

Student Leadership and Advocacy Opportunities

Leadership cultivates a sense of personal and social responsibility that starts the process of understanding one's own values and the influence they have on others (Shieh, 2008). In our global society our choices impact others. Educators need to make students feel that their individual abilities are valued and have value beyond the reach of a classroom and their community. Teaching our youth that there is more than them and

those around them. Their actions and choices today impact their future and the future of our planet. Students need to take responsibility for them (Shieh, 2008).

Bailey, Hufford, Emmerson, and Eckert, (2017) conducted a participatory action research study to identify living leadership in prekindergarten through fourth grade girls. The study participants were 31 teachers that shared the voices of their 214 female students. After the teachers, in collaboration with the students, developed a student friendly definition of what a leader is, the teachers worked together to enhance their strong academic curriculum by adding a leadership program. The teachers involved as an unintentional consequence took on ownership of the program. Through the program, nine leadership traits were identified which provided access for students to take ownership of their own community and their own learning. During the second year of the program the students participated in monthly assemblies introducing leadership traits. Students identified personal leadership goals. The program provided a system-wide structure to recognize, appreciate, and talk about leadership qualities. The results of the study showed two major changes, first was the change in understanding of leadership itself and second was they noticed that the girls supported each other in using leadership traits, making leadership "communal property that the girls owned collectively".

The researchers found that through the implementation of the leadership program there was evidence of leadership identity development. Leadership behaviors became spontaneous, consistent, and were done with positive attitudes. The program reinforced leadership behaviors and through observation, teachers were able to outline a process where students learned, gained confidence, and developed self-efficacy in leadership skills.

A yearlong, community-based participatory research study was conducted by Massey, Wilkison, and Whitley (2018) to determine the impact of a multicomponent school-based recess and physical activity program. A national nonprofit organization worked to provide opportunities to engage in positive and productive play through an inclusive school and recess culture for the students in the low-income, urban school district. Leadership opportunities were given to fourth- and fifth-grade students and were trained as junior coaches to lead recess periods for the younger students. The researchers conducted fifteen focus groups of five to eight participants in each, totaling 77 fourth and fifth grade junior coaches across eight elementary schools.

The results showed that the participants expressed a desire to be a positive influence among their peers as a role model and to serve as positive agents of change. Taking on the role of junior coach was transformational for many participants because they felt like they were really making a difference for their peers. They discussed their responsibility of maintaining a positive recess climate and increasing participation in activities during recess. Themes that arose during the study included leadership/being a role model, conflict resolution, communication, helping others, games/recess setup, and increased initiative as a catalyst for individual behavior change.

Seemiller (2016) defines leadership competencies as, "knowledge, values, abilities, and behaviors that help… successfully engage in a role or task." (p.51). Advocacy provides support for a particular cause. Providing students with leadership and advocacy opportunities keeps them engaged and motivated to learn and make a difference in the world. According to Himmele and Himmele (2017), "Creating classroom opportunities for developing higher-order thinking is essential for helping students

become critical thinkers, problem solvers, innovators, and change makers upon which every society thrives." (p.15). By incorporating sustainability into the curriculum, we are creating the ability for students to take on leadership roles.

Allowing students to personalize their learning empowers them to investigate problems, design solutions, and chase curiosities. The four attributes to personalized learning are voice, co-creation, social construction, and self-discovery. Student voice enables them to be involved in "the what" and "the how" of their educational experience. Co-creation is students working with teachers to develop a problem or a challenge. Social construct is working on common learning goals through building relationships with others. Self-discovery is students understanding themselves as learners (Kallick & Zmuda, 2017). These four attributes allow students to become leaders in their learning and become advocates for change. Personalized learning has a positive impact on student engagement. It allows for curriculum choice, voice, and students to make decisions about what they want to learn and how they want to change the world (Quinn & Owen, 2016).

Role modeling can be a form of student leadership. Education for sustainability can provide role model opportunities. True understanding is being able to incorporate learned concepts into everyday behaviors. Teachers are usually thought of as being the models but through promoting sustainability, through systems and actions, everyone can serve as role models. Modeling is an effective way to demonstrate knowledge, skills, and behaviors that motivate students to learn and develop values. Sustainable practices can be modeled by teacher for students, students for students, students for teachers, and teachers for teachers. Sustainable practices that can be modeled daily in the school setting are sorting garbage in the classroom and cafeteria, using reusable water bottles

and lunch bags, and reducing energy consumption by turning off the lights and electronics in the classroom. Modeling is effective in achieving sustainability education goals (Lyons Higgs & McMillan, 2006).

Schools should provide opportunities for students to have a voice and make informed decisions about issues that affect them and society. The film, *A Plastic Ocean* ends with the quote, "From knowing comes caring, and from caring comes change." (Leeson, 2016). This incapsulates education for sustainability. Once students gain knowledge about an issue, they begin to care about it and can become advocates for change. Encouraging student leadership and advocacy prepares students to be active and informed citizens (Quinn & Owen, 2016). Research often leaves primary school students out when thinking about student leadership, advocacy, and voice. Through this study, the researcher hopes to change this.

Integrated Curriculum

Students are not empty vessels coming into the classroom waiting to be filled. Research shows that students actively construct their knowledge based on their own experiences (Eames, Quinn, & Taylor, 2015). They use their prior knowledge to understand new concepts. According to Ray (2002), "Constructivists believe that learning occurs when children encounter new experiences and concepts and seek to assimilate these into their existing cognitive structures or adjust these schemas to accommodate the new information." (pg. 319). The constructivist movement emphasizes the active role of the student (Terwel, 1999). Teachers scaffold learning based on students' prior knowledge. Teachers reflect on their teaching practices and provide students with opportunities for choice (Ray, 2002).

Many things are analyzed when designing curriculum. According to Cheng-Yu & Yi-Chang (2018), "Effective curriculum design is key to successful student learning and outcomes." (p.1). Learning standards must be addressed and educators must show evidence of student achievement and engagement. An integrated curriculum is a way of meaningfully combining standards together within and across disciplines (Drake & Burns, 2004). There are many standards to address in each discipline. This must be done in a limited amount of time. Some teachers see an integrated curriculum is the only way to cover all of the standards (Drake & Burns, 2004). According to Drake and Burns (2014), "In the transdisciplinary approach to integration, teachers organize curriculum around student questions and concerns" (p.13). Through this approach, disciplines are integrated through project-based learning and negotiating the curriculum holistically.

In 2021, a research study was conducted by Boche, Bartel, and Wassilak of a teacher preparation program for elementary education that came up with three principal approaches to teaching integrated content areas. They included overarching themes to create connections among domains, interdisciplinary approach in which content or processes in one domain are used to support learning in another, and an integrated approach which emphasized a balance of two or more domains. They found the need for a connection between disciplines is driven by the shift in standards that require more of an integration of knowledge and skills in each content area. This study found that there was an emphasis on math and literacy instruction and science and social studies was taught in the afternoons when time allowed.

The sample included twelve preservice education students. Their fieldwork included field experience (observations) and student teaching. Over the course of three

semesters, they collected field experience lesson plans, a survey of experiences, video-recorded lessons, and the edTPA. They categorized the lessons in their field work as no integration, thematic integration, interdisciplinary integration, or full integration. The results showed that seven out of twelve experienced lessons with no integration of content of any kind, three out of 12 experienced thematic integration, seven out of 12 observed interdisciplinary integration, and only four saw a total integration. The researchers came to the conclusion that although integrated teaching was encouraged, due to the schools' selection of curriculum it lacked the theoretical framework to deliver integrated lessons.

A qualitative study conducted by Doyle, Hofstetter, Kendig, and Strick (2014) of arts-integration was conducted to observe student growth and challenges. The study included observations of professional development and in classrooms during art activities. 30 items were tested to measure teacher growth in comprehension of the national standards and the implementation of the arts-integration method in the classroom over a two-year period. The English Language Arts benchmark assessments were given in the first and third quarters as an intervention-comparison to assess student growth. The study found that the teachers had little understanding of what arts integrated projects and lessons were and how they would support student learning when the study and implementation began.

The results showed there was statistically significant growth in both years. 34 teachers who provided answers on both tests, the year 1 post-test mean was 13.5, SD=5.54, and the mean on the year 2 post-post-test was 16.56, SD=5.16, $t(33) = 3.66$, p post-post-test was 16.56, SD=5.16, $t(33) = 3.66$, $p < .01$. It was found that teachers

reported shy and low performing students took risks and experienced success when arts were integrated. One teacher reported an increase in listening skills and motivation. The student benchmark results were mixed. The analysis found both positive and negative statistical significance. In the first year of the study, the sixth-grade students showed significantly lower gains than the students at other grade levels. The second and third grade students showed significantly greater gains. In the second year, there was no statistically significant difference when comparing the student growth in third, fourth, or sixth grade, however there was a statistically significant amount of growth in second grade.

Erickson and Young (2011) conducted a study around professional development and curriculum design. The district identified a need for outside professional development to address the problem of non-tested content areas such as science and social studies regularly being eliminated by the teachers in order to have time for the mathematics and literacy curriculum demands. The researchers conducted the study in hopes to alleviate the problem in relation to social studies. The researchers worked with kindergarten, first, and second grade teachers to infuse social studies content into the literacy curriculum. The researchers created professional development to implement a Book in a Bag project where teachers would create integrated literacy and social studies lessons. A self-study methodology was used for deepening the understanding of the teachers, the teacher educators, and for future relationships with teachers and teacher educators. Unfortunately, the study found that the novice and experienced teacher participants struggled with finding grade appropriate, high-quality texts, settling on lesson objectives and instructional activities, and using technology. These issues became

roadblocks for the researchers unsure of how to proceed. After weighing the options, the researchers decided to make major revisions to the participants' work trying to retain as much as possible. The curriculum was given to the teachers to begin implementation. The teachers commented on the convenience of having the material ready and available in one place. It provided the teachers with a way of teaching an integrated literacy and social studies curriculum. As the implementation continued, and the high-stakes testing got closer, the teachers grew frustrated and vented about not having enough time and the integrated curriculum stopped being used. Although the outcome of this study was not positive, it did provide some additional insight to the inability of many teachers to create their own curriculum and the time constraint difficulty of addressing standards in all disciplines when they are taught in isolation.

A commonality among these studies showed that researchers are identifying a lack of time to address all content areas as a reason for a need for integrated curriculum. They identified a lack of understanding and resources to teach an integrated curriculum. Additionally, both in-service and preservice teachers need professional development and are often not trained to create curriculum (Boche et. al., 2021; Doyle et.al, 2014; Erickson & Young, 2001).

Curriculum designers create a curriculum with specific intentions of how the curriculum will be used. Pacing guides are created with content standards in mind. When integrating additional pieces into the curriculum it must be evaluated to maintain its integrity to ensure the intended standards are being met in the allotted time (Penuel et al., 2014). When using the constructivist approach to integrate curriculum, teachers that are implementing the curriculum must have a deep understanding of how the curriculum

was intended in order to address the necessary learning standards. Keeping the integrity of a curriculum is important when making changes to it.

Curriculum that embeds Education for Sustainability draws on constructivist theory and actively engaging students in their learning. This is done through cooperative and collaborative learning. Pedagogy focuses on critical thinking and action-oriented approaches to effect change (Eames et al., 2015). Teachers draw on students' experiences by encouraging them to identify issues and empowering them to be leaders for change. Teaching that is aligned with constructivism is demanding on teachers because they need to able to adjust their instruction to incorporate student's prior knowledge and choice (Ray, 2002). They need to be able to adjust their teaching strategies and lessons to scaffold for the students. An integrated curriculum is a way to embed sustainability while addressing the mandated standards.

Conclusion

As previous research suggests, there are benefits to teaching education for sustainability. A transdisciplinary approach allows students to deepen their learning by transcending the disciplines of STEM by incorporating global environmental issues. This study can serve as a model for other schools to demonstrate how an integrated curriculum approach can alleviate some of the concerns of teachers not having enough time or knowledge about the topics. By embedding sustainability themes into the curriculum, it provides opportunities for student leadership. Student leadership opportunities allow students to be independent thinkers, preparing them for their careers, and to advocate for a more sustainable future.

CHAPTER 3

Introduction

The previous chapters of this study explained the context of the study and the importance of embedding environmental sustainability into an integrated curriculum. The theoretical framework and the significance of the study were explained, and an in-depth literature review was conducted. This chapter will go into depth explaining specific methodology and why this methodology was chosen. The methods and procedures for this case study will be explained. A step-by-step description of the multiple methods that were used for data collection will be provided. The study's design will be discussed to examine trustworthiness, including the researcher's role.

Research Design

The researcher used a case study methodology for this research. Case studies are in-depth investigations consisting of two or three research questions about complex issues within a discipline or field of knowledge. Researchers conduct case studies to understand an activity or program within a bounded system. A bounded system is a fixed time and place. It is an inquiry that investigates a contemporary phenomenon within its real-life context (Yin, 1994). The researcher analyzed how a district created an integrated curriculum that embedded the themes of sustainability into their STEM program and to their curriculum as a whole.

Intrinsic case studies are done because of the issues' closeness to the researcher. The researcher was intrinsically motivated to conduct the study because of her work as the sustainability coordinator in her school in the New York City Department of Education. She created a Green STEM program in her school and works to embed

sustainability initiative throughout her building. This research study aimed to gain a deeper understanding of what another school district has done to enhance the opportunities for students around environmental sustainability. The researcher is seeking to find unique and common attributes within the programs and activities the participants share.

In this study, the case is a composite of four schools in one school district. The case was studied to gain a better understanding of the district's integrated curriculum. The researcher used three sharpened research questions to help structure the interviews, focus groups, and document review. These forms of data were then analyzed to form interpretations about the case being studied. Case studies according to Stake, can have a flexible design where the researcher can make changes to the design of the study, called progressive focusing, even after they begin the research (1995). In order to gain deep understanding of the case being studied, the researcher was able to adapt the open-ended questions in the interview protocol based on the information the participants shared.

The research questions in this study were addressed using a qualitative case study methodology. The researcher conducted a case study, researching STEM programs and the district's integrated curriculum that incorporate sustainability at four sites (schools) within one district. The leadership opportunities the students had were analyzed. The sites were compared to find similarities and uniqueness. The researcher provides an analysis of the programs and student leadership opportunities (Creswell & Poth, 2018). With this research methodology, the researcher gathered rich detailed descriptions of how the teachers and administrators perceive the opportunities the students had and their teaching practices.

Case studies allow for strong interpretation and to advance understanding of the phenomenon. Case studies are often used to study people and educational programs and offer an enhancement of understanding. Case studies offer an opportunity to provide thick descriptions of the phenomenon for the reader to be able to experience the case as if they were there (Stake, 1995).

Case studies allow the researcher to be in the field as an observer to objectively record while at the same time determine what is happening and to examine and refine or substantiate the meaning of it (Stake, 1995). Unfortunately, this study took place during the COVID-19 pandemic when researchers were not allowed to be in the school setting to observe, so the researcher relied on the interviews with participants and the document analysis to understand how they perceived the student opportunities. The researcher relied on her experiences, literature, and data analysis to formulate understanding and meaning about the phenomenon. The case is bound by place and time.

The researcher examined the case by doing an in-depth data collection from multiple sources, including interviews with administration from all four schools, interviews with STEM and classroom teachers, a focus group, and through document analysis. The researcher gathered a picture of each of the schools during this specific timeframe of research. The researcher stayed within the boundaries of the case while gaining a holistic understanding of how the case functions based on the data collected. To explain the phenomena, the researcher gives a detailed description of the case.

An examination into educators' perceptions of how teaching environmental sustainability through an integrated STEM curriculum is both relevant and contemporary because of the global climate crisis. As illustrated in the review of the literature, an

integrated curriculum is found to be a way of including all the necessary standards and the important topics around sustainability in the limited amount of time in a school year. This case study focused on educators' perception of their integrated curriculum, where and how students were provided with leadership and advocacy opportunities around sustainability, and how the teaching and learning culture changed.

According to Yin (1994), a case study can be exploratory, descriptive, or explanatory. The type of research questions determines the type of case study it is. This case study is an explanatory case because the research questions are how and why questions. First, the researcher focused on understanding how and why the district chose to create an integrated curriculum. Then she investigated the processes useful for embedding sustainability themes into the integrated curriculum. The first two research questions focus on the development of the district wide curriculum. The third research question focuses on how educators perceive the implementation of the sustainability themed curriculum and how it changed the schools' teaching and learning culture by providing leadership opportunities for students. With deep-level investigative questions, the researcher gained a broad understanding of the level of engagement and leadership opportunities provided to students through the sustainability themes within the integrated curriculum that would not be able to be gathered through surveys or other data collection.

Research Questions

1. What processes are useful for embedding sustainability into an integrated curriculum?
2. How is a sustainability themed curriculum implemented?

3. How has the implementation of a sustainability themed curriculum changed the school's teaching and learning culture?

Methods and Procedures

Setting

The schools involved in this case study are in a school district in Long Island, New York. For the purpose of this study, I will refer to the district with the pseudonym, the Morris School District. I determined that this school district had unique qualities that met the criteria for the study. It has an integrated curriculum that was created by the Morris School District. They chose to stop using a commercial English Language Arts, Social Studies, and Science curriculum for grades pre-kindergarten through seventh grade when the state standards were changing from the Common Core Standards to the Next Generation Standards. At the time of this research study, the district had been using the integrated curriculum for three years.

Within the Morris School District's mission statement, they incorporate environmental sustainability. Through the district's very active social media it was clear that the ideas in their mission statement were living in their school practices and in their integrated curriculum.

The study was conducted during the COVID-19 pandemic, so the district superintendent was contacted via email communication. The researcher provided the superintendent with background about the study and why she was interested in this particular district. The superintendent consented to giving access to the researcher. He approved of her reaching out to the staff and gave access to the district's integrated curriculum.

Once approval to conduct the study was granted, the researcher used the district's website to retrieve the contact information for district faculty that would be the most pertinent to the study. The participants were contacted through email. Willing participants were sent consent forms and once they were signed, virtual interviews were scheduled. The interviews were conducted over WebEx at a convenient time for the participants. Some of the participants chose to meet virtually during school hours while others were interviewed in the evening. Follow up emails were used to communicate additional information and to ask follow-up questions.

The district is in a suburban neighborhood in New York State. Four schools within the Morris School District were studied (see Figure 6 and Table 1). There are two prekindergarten through second grade schools, one school for third and fourth grade students, and one middle school that is fifth through seventh grade. According to the New York State Education Department (2019) publicly reported educational data for the 2018-2019 school year, the participating district is in "good standing". The demographic makeup of the district (see Table 2) is 2% black, 30% Hispanic, 13% Asian, 53% white, and 2% multiracial. English Language Learners make up 11% of the population. 12% are students with disabilities. 32% of the students are economically disadvantaged. There are about 230 students per grade. The district proficiency rating is slightly above the state average in English Language Arts (grades 3-8), mathematics (grades 3-8), and science (grades 4 and 8) on the standardized exams.

Figure 6

Organizational Chart

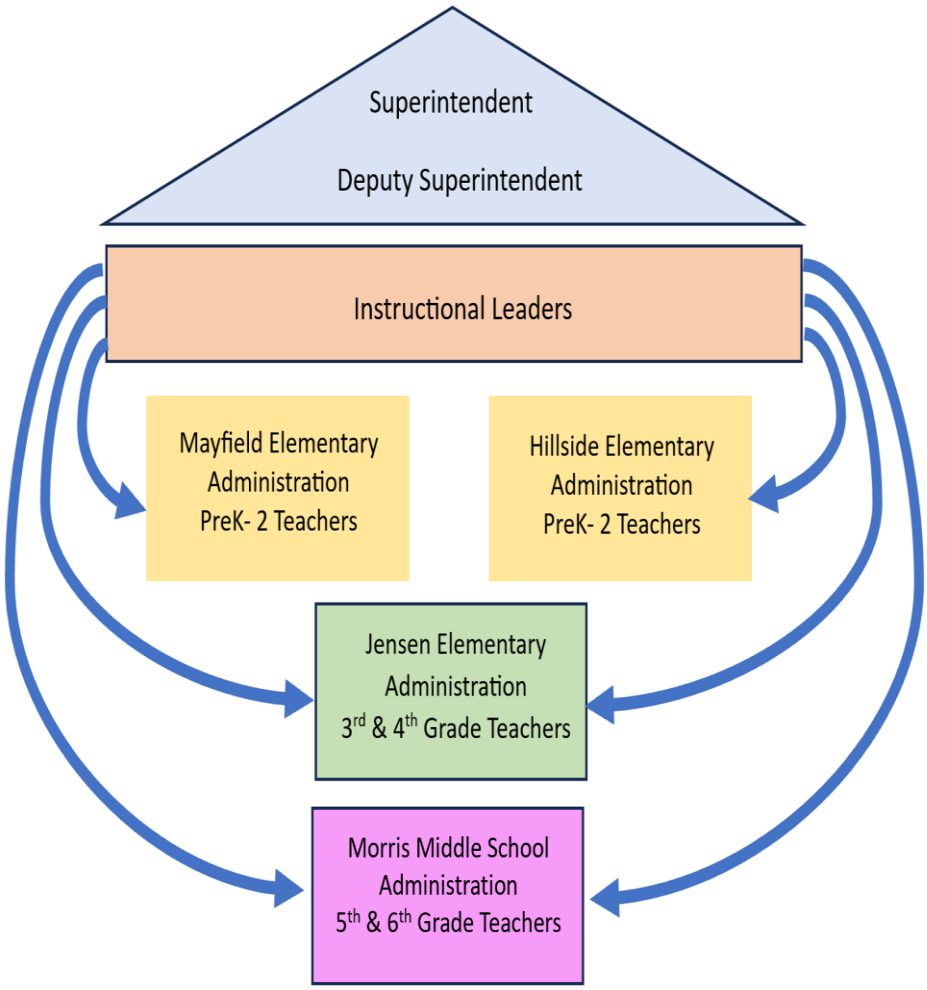


Table 1

Description of Schools

School Pseudonym	Grade Levels	Number of Students Served	Number of Participants
Mayfield Elementary	Pre-K, K, 1, 2	387	5
Hillside Elementary	Pre-K, K, 1, 2	369	3
Jensen Elementary	3, 4	434	7
Morris Middle	5, 6, 7	607	4

Table 2

District Demographics

Ethnicity		Subgroups	
Black	2%	English Language Learners	11%
Hispanic	30%	Students with disabilities	12%
Asian	13%	Economically Disadvantaged	32%
White	53%		
Multiracial	2%		

Participants

For this study, a total of 19 participants were interviewed. They included school administrators, STEM teachers, and classroom teachers (see Table 3). By getting perspectives from three different groups of participants, the researcher was able to gather substantial data illustrating a full picture. The participants had a varied amount of experience, ranging from four to thirty-six years in the field of education. Their experience in their current roles ranged from it being their first year to it being their sixteenth year. The participants' education ranged from a bachelor degree to a doctorate in education. The researcher interviewed an administrator and the STEM from each of the four schools and classroom teachers of various grade levels. The number of participants was sufficient to answer the research questions and provided a vast amount of data that became saturated.

Purposeful sampling was used to conduct this case study. Purposeful sampling is intentionally choosing participants that can best inform the research topic (Creswell & Poth, 2018). Purposeful sampling involves getting varied perspectives. By interviewing administrators, STEM teachers, and classroom teachers the researcher is able to get a full picture of the implementation of the integrated curriculum. The participants were

Table 3

Description of Participants

Administration

Participant Pseudonym	Role	Years in Education	Years in District	Years in Current Role	Degree
Tara	Morris Middle School Principal	12	6	1	MA
Georgia	Jensen Elementary Principal	26	8	8	EdD
Sarah	Mayfield Principal/ Former District Instructional Lead	17	5	5	MA
Frances	PreK-2 Virtual School Principal/ District Media Specialist	8	3	3	EdD

STEM Teachers

Participant Pseudonym	Grade Level	Years in Education	Years in District	Years in Current Role	Degree
Rachel	K,1,2	20	20	3	MA
Rebecca	K,1,2	9	8	5	MA
Diane	3, 4	35	34	9	MA
Carmine	6	20	20	8	MA
Grace	5, 6, 7	5	3	3	MA

Classroom Teachers

Participant Pseudonym	Grade Level	Years in Education	Years in District	Years in Current Role	Degree
Kelly	K	29	16	6	MA
Ramona	K- ICT	16	13	1	MA
Cara	2	6	6	4	MA
Brianna	3	29	27	7	MA
Caroline	6	36	36	15	MA
Sofia	K	24	24	16	MA

Focus Group: 3rd Grade Dual Language Teachers

Participant Pseudonym	Years in Education	Years in District	Years in Current Role	Degree
Renee (Spanish)	5	5	4	MA
Penelope (Spanish)	4	3	3	MA
Faith (English)	4	4	2	BA
Paulina (English)	6	5	3	MA

selected purposefully by first contacting and interviewing school administrators and STEM teachers. Once they were interviewed, they were asked who they believed to have sustainability initiatives as a priority focus. The researcher was not able to have on campus access due to the COVID-19 pandemic which led to snowball sampling. Snowball sampling is using a few cases to encourage other participants to take part in the study (Taherdoost, 2016). The school administrators and the STEM teachers acted as informants to help recruit other faculty that would elicit data needed to answer the research questions.

As a district, the staff has had extensive training in student leadership and social-emotional learning. The district has an integrated curriculum and places a high emphasis on STEM education. The district has a committee that focuses on Education for Sustainability. This committee is comprised of administrators and teacher leaders that have received additional professional development around Education for Sustainability. They work together to make decisions for the district on ways of improving the facilities and the curriculum to align to the district's mission statement around sustainability. The administrators were selected as participants because they have the unique perspective of observing all the teachers in their school and they have insight as to where sustainability is integrated throughout the entire building. The teachers participating in the study are STEM teachers from each of the schools and classroom teachers that teach various grade levels. All of the classroom teachers implement the integrated curriculum which embeds sustainability themed activities. The participants have also been selected because of their varied experience in the field of education.

In addition to the interview participants, the researcher held a focus group. The focus group consisted of four, third grade teachers that are part of the dual language team. Two of the teachers teach the Spanish side of the program and two of the teachers teach the English portion of the dual language program. They were chosen to bring an additional perspective. Their program has an additional component of teaching in two languages which adds to the demands on the teachers, making it even more necessary to have an integrated curriculum and collaboration between the teachers.

Sample Size

In qualitative research, the goal of data collection is to gain extensive detail about the cases that are studied. A large number of participants is not always needed (Creswell & Poth, 2018). A saturation method was used to determine the sample size. Saturation is used in the data analysis phase to determine that the researcher has collected from the participants the data needed. The data is saturated when the researcher is not getting any new information from the participants. The researcher interviewed one administrator at each building and at least three teachers including the STEM teacher at each school building. There is a total of nineteen study participants. The researcher analyzed the data as it was being collected. Once the information from the interviews and focus group became saturated the interview process concluded.

Data Collection Methods and Procedures

The methods used were virtual interviews with administration and teachers, a virtual focus group, and a collection and analysis of artifacts and documents (see Table 4). Multiple methods were used to triangulate the data for trustworthiness. The same data collection methods and procedures were used at each school to maintain continuity

of the data. This allowed for a better analysis of the data. Systematic, rigorous data collection, and analysis is required to minimize bias and establish trustworthiness.

Table 4

Data Collection Methods

Interviews	Virtual one-on-one interviews with teachers and administrators Follow up questions via email
Focus Group	Virtual focus group of 4 teachers Group asked interview questions and presented with artifacts/ documents to describe and elaborate on
Artifacts/ Documents	Student work Curriculum- lesson/ unit plans District newsletters District presentations Social media posts

Interview Protocol

Interviewing is the main method for collecting data in a qualitative study (Spradley, 1979). The researcher began the study by interviewing administrators. Then she moved on to STEM teachers and next the classroom teachers. The researcher conducted semi-structured virtual interviews. Semi-structured interviews are a series of questions designed to elicit specific answers from the participants (Wallen & Fraenkel, 2000). The information obtained from the interviews were later compared. Interviews were very useful in this study. Through the interviews the researcher was able to gain the perspective of the participants in order to share the phenomenon and a model for other educators.

A sequence of themes and suggested questions were prepared in an open-ended format to not lead participants. Semi-structured interviews allow for the sequence and

form of questions to change depending on the answers given by the participants (Kvale & Steinar, 1996). The researcher also used retrospective interviews. According to Wallen and Fraenkel (2000), "A researcher who conducts a retrospective interview tries to get a respondent to recall and then reconstruct from memory something that has happened in the past." (p.442). These allowed the participants to share experiences and perspectives they have had in which the researcher was not present. This allowed the researcher to gain a deeper understanding of the participants' perspectives.

The semi-structured virtual interviews were recorded to allow for an accurate account of what took place. The researcher held the virtual interviews in a private and distraction-free environment in her home and the participants were either in their office, classroom, or home. The researcher first reminded the participants that their participation was voluntary. She then asked background questions to ease the participants and to build rapport. The participants were asked to speak freely and were reassured that their identity would be concealed.

Developing rapport is important for gathering meaningful information. The beginning of rapport building was done in the initial email correspondence with the participants. Apprehension was further eased once the interviews began by telling participants that the interviewee is a teacher and has participated in research studies herself and understands how uncomfortable it can be. The researcher let the participants know that there were no wrong answers and that they could speak freely knowing pseudonyms would be used when sharing the research finding.

The researcher followed the interview protocols (Appendixes E and F). She started by asking the participants background questions to gain insight into their current

position and their experience in the field of education. Then the researcher moved on to the questions pertaining to the school's integrated curriculum. She asked why the district began using an integrated curriculum and who was involved in creating it. Questions about teacher flexibility and pacing within the curriculum were asked. Then the researcher moved onto questions around the integration of sustainability themes in the curriculum. She asked the participants to describe times that students were engaged in sustainability themed activities. Table 5 offers sample questions the researcher asked the participants. The full interview protocol for both administrators and teachers can be found in appendix E and F respectively. The researcher asked open-ended probing questions to encourage the participants to paint a full picture of what their students engage in. At the end of every interview the participants were asked if there was anything additional they would like to tell the researcher about how sustainability is integrated in their school. This left the participant with an opportunity to add any other information they thought might be relevant to our conversation.

Table 5

Sample Questions for Participants

Administrators	Teachers
What are your views about your school's integrated curriculum?	What are your views about your school's integrated curriculum?
How/why did your school/ district begin using an integrated curriculum?	Have you been involved in the planning or decision making of your curriculum?
Who was involved in planning the units?	

Where do you see sustainability themes being integrated into the curriculum?	Where are sustainability themes being integrated into the curriculum?
Who are your key players? (Is there a grade level, unit, or enrichment program that has sustainability themes?)	Do you have flexibility within your units to integrate additional topics/ lessons?
What is your role in integrating sustainability into your building?	Are you able to adjust the pacing of your curriculum based on student needs or student choice?
Can you tell me about a time you observed teachers and students engaged in sustainability themed activities?	Can you tell me about a time that students were engaged in sustainability themed activities? What was the students' engagement level?

The researcher asked descriptive questions probing the participants to expand on their thinking (Spradley, 1979). In follow up interviews, the researcher provided some of the documents that were collected by sharing the researchers screen with documents previously collected, asking participants to share their thinking about the artifacts. The researcher asked the participants to tell stories and to elaborate on their experiences. The researcher had a few prewritten questions and general themes prepared to allow for flexibility. Having an interview protocol that allowed for flexibility helped the participant feel more at ease because it may have felt less formal for them.

The interviews took place on WebEx, and they were recorded with the participants' consent. This allowed for accurate transcripts to be made and the researcher was able to fully immerse herself in the data. All of the interviews lasted between 30 and 60 minutes. Table 6 describes the alignment between the interview protocol questions and the research questions.

Table 6

Alignment between Research Questions and Interview Questions

Research Questions	Interview Questions
What processes are necessary for embedding sustainability into an integrated curriculum for it to occur in a school?	What are your views about your school's integrated curriculum? Tell me about the planning and decision making of your curriculum?
How are sustainability themes integrated into the curriculum?	Where are sustainability themes being integrated into the curriculum? Who planned the integration of sustainability themes?
How has the implementation of sustainability themed curriculum changed the schools' teaching and learning culture?	Tell me about a time that students were engaged in sustainability themed activities? What was the activity/ unit/ lesson/ theme? How long was the activity/ unit/ lesson? Where did the activities take place? What was the students' engagement level? Tell me about the activity the students worked on.

Artifacts and Documents

Documents and artifacts were collected throughout the study. According to Creswell and Poth (2018), artifacts and documents are used to supplement focus groups and interviews. They can provide a context to information that is gathered using other methods. Documents can be broken down into three categories, personal, official, and pop culture. In this study, samples from all the categories were collected and they include but are not limited to, organizational documents, curriculum and lesson plans, student work, district newsletters and presentations, Board of Education meeting minutes, social media posts, and teacher created materials.

The researcher used a document analysis protocol to examine documents (Appendix G). The documents were examined to determine who, why, and when they

were produced. The type of data was identified and how the themes of sustainability were incorporated into each item. The documents were used to corroborate the data collected from the interviews and focus groups.

After analysis by the researcher, the documents were used as talking pieces during follow up interviews and focus groups. The researcher provided copies of the documents to the participants to elicit conversations about the activities that took place. The interviewer asked participants to tell stories and to elaborate on their experiences. The researcher had a few prewritten questions and general themes prepared to allow for flexibility.

Focus Groups. A virtual focus group was conducted with teachers that collaborate on units of study. The focus group consisted of four teachers that work in the dual language program. They were audio recorded for accuracy in data collection. Following individual interviews and document gathering, the interactions between teachers further developed the data that was previously gathered. Interactions between the focus group participants provide additional information when they cooperate with each other (Creswell & Poth, 2018). The focus group protocol was used to guide the discussion (Appendix D). Collected documents were used to encourage a dialogue between the participants. The focus group was able to elicit additional data because the participants were able to build on the ideas of each other. Several times, one participant began speaking about their experience and then the other teachers would elaborate on their experience with the same or a similar lesson.

Fieldwork Journal. During data collection the researcher kept a fieldwork journal that helped to organize day-to-day thoughts and to process the data collected.

The fieldwork journal had the list of participants, a schedule of interviews and focus groups, and the researcher's protocols. The fieldwork journal was used for initial jotting of thoughts and then was used to record information about the time spent in the virtual field, outcomes of interviews and focus groups, and thoughts and feelings about the fieldwork (Gibbs, 2007). Each entry began with the date, day of the week and time of the interview or focus group. It included the modality of facilitation of the activity, such as Webex. The researcher planned for time directly after the interview to add full description (Creswell & Poth, 2018). After reflecting on and analyzing the information gathered from the first round of interviews, the journal was used to jot down follow-up questions for participants and the next steps in data collection and analysis.

Trustworthiness of the Design

In qualitative research, trustworthiness refers to credibility, transferability, dependability, and confirmability. In this study the researcher confirmed trustworthiness by ensuring these four elements. Credibility is how truthful or reliable the researcher's findings are. Transferability allows for the findings to be applied to other contexts. Dependability is the ability of other researchers to be able to replicate the study. Confirmability is the degree of the researcher's neutrality (see Table 7).

Table 7

Techniques to Establish Trustworthiness During Data Analysis Spiral

Data Analysis Spiral Activity	Technique for establishing Trustworthiness
Step 1: Managing and Organizing the Data	Organizing and storing raw data in a password protected computer and computer-assisted software program (ATLAS) Prolonged engagement

Step 2: Familiarizing Oneself with Data and Memoing Emergent Ideas	Data triangulation Reread field notes and transcripts Document potential codes Memo thoughts and questions
Step 3: Cycles of Coding and Categorizing	Self-code and code generation in ATLAS Audit trail of coding Peer review Member checking
Step 4: Theming the Data	Organize codes to categories to themes Peer review Member checking
Step 5: Developing and Assessing Interpretations	Peer review Reflex journaling Member checking
Step 6: Representing the Data	Thick descriptions Describe process of coding and analysis Report reasons for the theoretical, methodological, and analytical choices

There are several ways to increase trustworthiness as a qualitative researcher. In order to have credibility, the researcher must present findings that are truthful and accurate. In this study, triangulation and prolonged engagement are the way of doing this. Transferability is the extent that the findings can be generalized to other situations. This was achieved by providing thick descriptions which allow others to make informed decisions. Dependability is having consistency, trackability, and a logical flow between the research design and process. To have dependability, the researcher kept accurate records, reported fully, and created codes that match the research question and design. Member checking and peer review increase dependability. Confirmability is being able to track the data back to its original source. The researcher has an audit trail that shows

the process from the raw data, to memoing, coding, and then creating themes (Lincoln & Guba, 1985).

Triangulation. Triangulation is a strategy used to increase validity in qualitative research. Data triangulation refers to collecting data from several sources such as multiple people. Methodological triangulation is using different methods of data collection such as what is being done in this study, interviews, observations, focus groups, and documents. If one method isn't providing enough information to justify data that has been collected, and/ or shows contradictions in data, the researcher will use different forms of data. Triangulation allows the researcher to converge multiple methods to create stronger explanations of the phenomenon being studied. In qualitative research, it is necessary to create a holistic picture of the case being studied, triangulation helps to do this (Mathison, 1988).

Prolonged Engagement. Prolonged engagement is a way to increase trustworthiness. Spending longer periods of time in the field builds rapport which allows the participants to be honest with the researcher (Creswell & Poth, 2018). An outsider's presence can cause participants to distort the way they behave. Participants may try to manipulate the truth to give the researcher what they think they want to hear. Prolonged engagement at the site can alleviate some of this (Guba, 1981). This is why the researcher will spend time in the virtual classrooms, making observations prior to interviewing participants and conducting focus groups. The longer the researcher spends in the field the more the participants will get used to it, therefore, the data gathered will be more natural. This will allow the researcher to form more accurate interpretations of what is taking place in the classrooms.

Neutrality. Having neutrality while in the field and interpreting the data is also a way of ensuring trustworthiness. Researchers need to stay objective and think of themselves as instruments (Guba, 1981). Predispositions can cause a researcher to see things with bias. As an educator, the researcher came in with her own background and assumptions but did her best to stay neutral and to be an outside observer that used the multiple forms of data collected to formulate conclusions. The researcher practiced reflexivity by keeping a journal. Continuous self-examination was done to avoid skewing the finding based on any potential bias. The researcher avoided interpreting the data to fit any preconceived narrative.

Thick Descriptions. Thick descriptions are necessary to increase transferability. During and after interactions in the field the researcher took notes using a full description of all contextual factors (Guba, 1981). When writing up the analysis, the researcher provided detailed descriptions of the participants and the setting being studied so someone reading the study should be able to feel like they are there. This allows them to transfer information to other settings and different cases (Creswell & Poth, 2018).

Peer Review. Peer review is a trustworthiness strategy that was used in this study. The researcher sought feedback from educators who are experienced in the field. This kept the researcher honest by taking time to debrief with colleagues that asked questions and provide alternate views (Guba, 1981). In addition to work colleagues, the researcher sought out peer review from Dr. Yang and the dissertation committee. Using multiple strategies gave this study more trustworthiness.

Data Analysis Approach

Data Analysis. Data analysis is not a linear process. Researchers move in analytic spirals, collecting data, analyzing it, interpreting it, and then collecting more (Creswell & Poth, 2018). The process continues in this spiral until the researcher is ready to create an account of their findings (Creswell & Poth, 2018). The researcher followed the data analysis spiral during the research, simultaneously collecting and analyzing data. The researcher continued this process until she was ready to make the final report of the interpretation of the findings.

Memos and codes. The researcher memoed after spending time in the field, rereading field notes, summarizing them, making notations, and creating codes. The recordings from interviews were transcribed and organized into files that were reread and memoed. Concept-driven coding started the process by using topics in research which provided ideas about what may come up in the field (Gibbs, 2007). As data was collected additional codes emerged and were considered during analysis.

After creating codes, the researcher made notes of themes. A qualitative data analysis program, ATLAS was used to assist in organizing themes that were identified (Creswell & Poth, 2018). The researcher used the technology to locate commonalities between participants' responses. Data gathering continued in the field until there was significant saturation. The researcher described the case and classified the code and its context into themes.

Through analyzing the data, the researcher looked at uniqueness and commonalities of the case and develop naturalistic generalizations, generalizations that people can learn from this case that can apply learning to cases in a similar context

(Creswell & Poth, 2018). The researcher synthesized data from multiple schools in the district as a tool to analyze the data (Yin, 2014).

Limitations

Many steps were taken in this study to ensure trustworthiness. That being said, there were still limitations. Due to the Covid-19 pandemic, the researcher was unable to meet in-person with participants. Conducting interviews virtually makes it less personal and more difficult to build a rapport with the participants. At the time of this study the pandemic did not allow the researcher to spend time in the schools to make observations in the field. The researcher was not able to be in the schools to notice artifacts, documents, or student work that was posted in the school. The researcher had to rely on the participants to share artifacts that pertained to the study, and other document collection methods such as district newsletters and social media posts.

Another threat to trustworthiness is time restraints. Due to COVID-19 and under normal circumstances the researcher and the participants only had a limited amount of time to spend on this study. The researcher would have benefitted from being able to spend more time in the field to observe and interview additional participants and witness more activities taking place, but both the researcher and the participants have limitations as to how much time can be dedicated to the study. The researcher did her best to ensure trustworthiness of this study, taking into consideration any shortcomings.

Research Ethics

Research Procedures. The researcher applied for approval from the University's Institutional Review Board (IRB). After IRB approval, the superintendent was notified that the researcher began reaching out to the schools' staff members. First the

administrators and STEM teachers were invited to participate in the research study. Once they agreed and signed written consent forms (Appendices B and C), interviews were scheduled. Through the first participant interviews additional teachers were identified as working in STEM programs or with sustainability initiatives within the district. Next, written consent was obtained from the additional participants and interviews were scheduled. Arrangements were made to conduct the interviews at a convenient time for the participants that would cause the least disruption to instructional time. During the interviews the researcher requested documents from the participants that were referenced in the interviews. As the information from the interviews became saturated the interview process was concluded.

Ethics. Researchers must follow ethical decision-making processes throughout their research to keep the participants free from harm. As stated previously, the researcher first submitted the proposal to the University's Institutional Review Board and received written consent from the superintendent. The researcher collected written consent forms from all of the participants. While collecting data, trust was built. Every effort was made to cause as little disruption to the participants' routines as possible, not asking leading questions, and avoiding disclosing any sensitive information. In order to seal the participants' identity, the researcher created pseudonyms for the participants as soon as possible and has the database on a password protected computer. All fieldnotes, transcripts, and documents are stored on a password protected computer that only the researcher has access to. When reporting the data, the researcher reported honestly, and member checked whenever possible. When there was no other way to conceal participants' identities, composite stories were used (Creswell & Poth, 2018).

Researcher Role

Clarifying research bias and engaging in reflexivity. The researcher works for the New York City Department of Education as an assistant principal. She is an outsider to the district that is being studied. She has no affiliation with it and gains no compensation for showing the district in a positive light. There is no incentive from the district for the researcher to manipulate the data. The district was chosen after researching many districts and determining that this particular district had sustainability as a district priority and a unique district created integrated curriculum.

As an elementary school educator for over 20 years and specifically a Green STEM teacher for eight of those years the researcher has seen first-hand the benefits and opportunities that teaching sustainability through STEM programs has given students. When she was the Green STEM teacher, the researcher integrated sustainability themes into the STEM curriculum. As the school's sustainability coordinator, she encouraged sustainable practices throughout the building. She has seen benefits of teaching students to look at the world through the lens of sustainability. This being said, there may be researcher bias, so the researcher engaged in reflexivity. She provided her background and explained how it may have impacted the data that was gathered and the interpretation of it. The researcher looked inward at herself as a researcher to become self-aware of biases, values, and experiences (Creswell & Poth, 2018).

The researcher has found that incorporating sustainability initiatives into a STEM program provides student leadership and advocacy opportunities. The researcher has witnessed students making change and developing a passion for improving their school, their community, and world they live in. In doing this study, the researcher hoped to find

teachers and students in other schools also finding benefits in integrating sustainability in their programs. The researcher was looking at students through the lens of sustainability, to develop a love of learning by taking leadership roles in their education and becoming advocates for a cause they believe in.

Conclusion

This case study used purposeful and snowball sampling. It included fifteen teachers and four administrators from elementary schools in a suburban district in New York State. Interviews and a focus group were conducted, and documents were collected. The researcher built a rapport with the participants. Semi-structured interviews were conducted using open-ended questions allowing for the participants to share their perspectives. Protocols were followed to avoid bias on the researcher's part. Throughout the research process the researcher implored trustworthiness strategies to validate the finding. Thematic analysis was used to analyze the data collected from the focus group, interviews, and documents. The researcher made every effort to overcome the limitations identified.

CHAPTER 4

Introduction

The purpose of this qualitative case study was to determine how a school district embedded sustainability into its STEM program and integrated curriculum. This study utilized a focus group of four teacher participants, fifteen individual interviews; eleven with teacher participants and four with administrator participants, as well as a content analysis of documents pertaining to the districts integrated curriculum and social media posts of students engaged in learning experiences during the 2020-2021 school year.

This chapter provides analysis of the collected data according to themes that emerged within the context of the research questions. There were three overarching themes that emerged from the analysis of the data collected throughout the study. The first major theme to emerge was planning and preparation of the integrated curriculum. Within this overarching theme, three sub-themes emerged which included addressing all the Next Generation Learning Standards, consistent faculty collaboration through regular professional learning communities (PLCs), and continuously reflecting on units through a virtual living document. The second overarching theme was the integration of systemwide sustainability practices. Within this overarching theme arose three sub-themes including infrastructure improvements to support the integrated curriculum, embedding sustainable practices into instruction across all content areas, and strengthening the school-community connection. The third overarching theme that emerged was teachers' reflections on their experience of teaching a sustainability-themed curriculum. Within this overarching theme, two sub-themes emerged which included challenges to student collaboration and enhanced student engagement through hands-on

activities and place-based learning (see Table 8). This chapter concludes with a discussion of the findings according to the research questions of the study.

Table 8

Overarching Themes and Subthemes

Overarching Theme	Sub-Theme 1	Sub-Theme 2	Sub-Theme 3
Planning and preparation of the integrated curriculum	Addressing all Next Generation Learning Standards	Consistent faculty collaboration through regular Professional Learning Communities	Living document
Integration of systemwide sustainability practices	Infrastructure improvements to support the integrated curriculum	Embedding sustainable practices into instruction across all content areas	Strengthening the school-community connection
Teachers' Reflection on the Experience of Teaching a Sustainability-Themed Curriculum	Challenges to student collaboration	Enhanced student engagement opportunities through hands-on activities and place-based learning	

Findings

Theme 1: Planning and Preparation of the Integrated Curriculum

An overarching theme that emerged during the analysis of collected data was planning and preparation of the district's integrated curriculum. Each of the participants shared their views on the integrated curriculum that the district has been implementing for the past three years. Within the theme of planning and preparation of the integrated curriculum, three sub-themes emerged from the data. The three sub-themes were addressing all the Next Generation Learning Standards, consistent faculty collaboration through regular professional learning communities (PLCs), and continuously reflecting on units through a virtual living document. Together these sub-themes explain why the

district initially decided to create an integrated curriculum and how it continues to evolve every year.

Addressing all Next Generation Learning Standards. The first sub-theme that emerged regarding planning and preparation of the integrated curriculum from the collected data was the need to address the changing standards. Participants in the focus group and interview participants, both teachers and administrators were asked why the district changed to an integrated curriculum and their views of the integrated curriculum. The school was moving from the Common Core Learning Standards to the Next Generation Learning Standards in English Language Arts, Social Studies, Science, and Mathematics. The district took an inventory of the curriculum they were currently using and found that it was not meeting the needs of the students they had in front of them. Sarah, one of the six Instructional Leaders (IL) for the district gave an example stating, "3rd grade used the state modules… they were very vast, very hard to read, and didn't really represent the children we had in front of us." Because of the changing standards the district had to make decisions that would be best for the students that they served.

Common among many of the participants was the concern of being able to address all the standards in the limited amount of time in the school year. Both teachers and administrators said it was not possible to address all the standards by teaching each subject matter in isolation. For example, Georgia, one of the elementary school principals said, "time is of the essence" voicing the concern of commercial curriculums for English language arts and mathematics, needing so much time to cover all the standards. Using the timeframes, the commercial curriculums suggest in their teacher implementation guides don't allow enough time for other subjects and district priorities

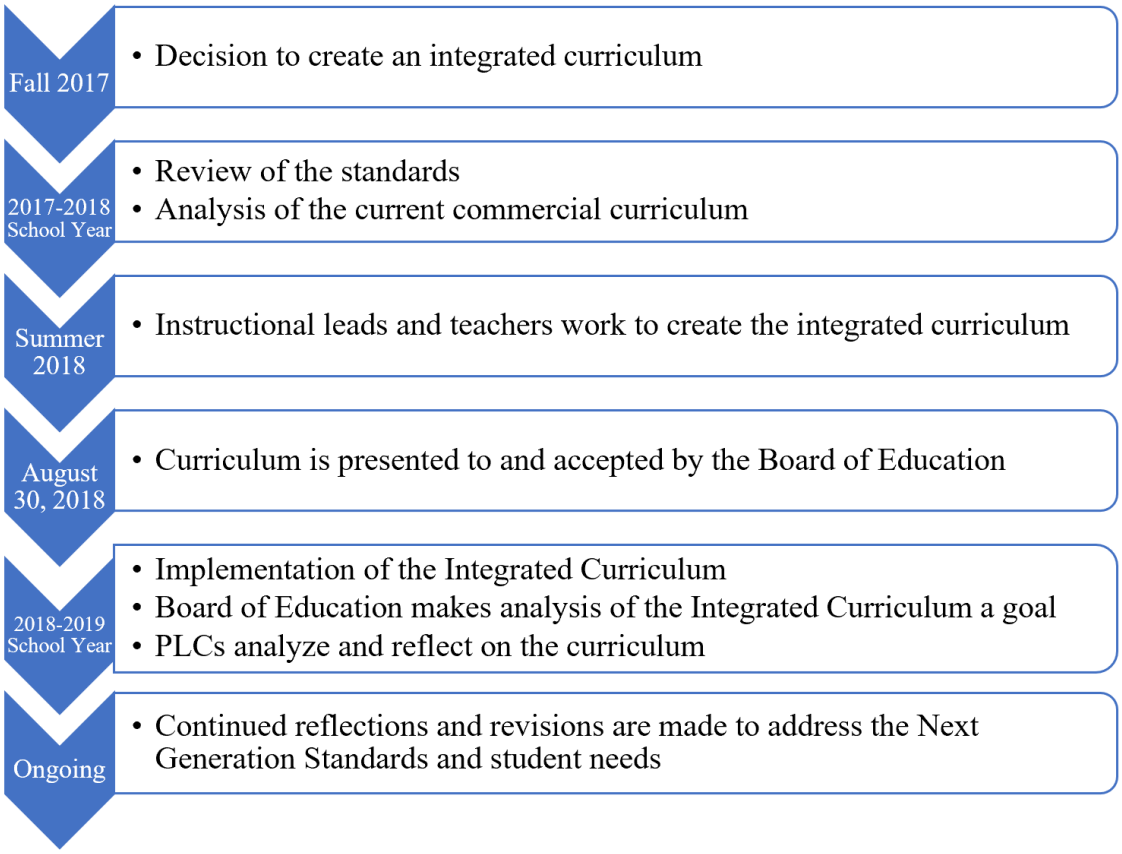
around mindfulness and sustainability. Sarah, the instructional leader shared that before there was a redesign of the curriculum, “there was a very clear focus on reader’s workshop but social studies and science weren’t happening enough” due to prioritizing English language arts and mathematics.

There are so many standard that need to be addressed in each discipline in the Next Generation Learning Standards. As a result, less time would be spent on science and social studies standards to cover all the English Language Arts and mathematics standards. According to Sarah, “it had to be integrated in order to make it doable for the teachers.” Georgia has a similar sentiment, saying, “moving to an integrated curriculum really helps solve the issue of time because now it's truly an integration and we're covering all social studies and science standards.” Sarah said, “it became clear that things needed to go together.” Rebecca, one of the STEM teachers shared that the students see her once or twice in a six day cycle which doesn’t give her enough time to address all of the science standards through her program. While at the same time, she “doesn’t want to put more on the classroom teacher’s plate.” She continued by saying, “we revamped the curriculum to make it as integrated as possible, so it hits all the standards and the kids are getting the best science education possible”. The district creating its own integrated curriculum has made it possible. It “fits the needs of our learners.”

According to the interview participants and corroborated with the documents collected, the district spent a year developing the initial integrated curriculum and continues to analyze, reflect on, and revise it (see Figure 7). During the 2017-2018 school year the planning and preparation for the integrated curriculum began.

Figure 7

Timeline of the Integrated Curriculum Design

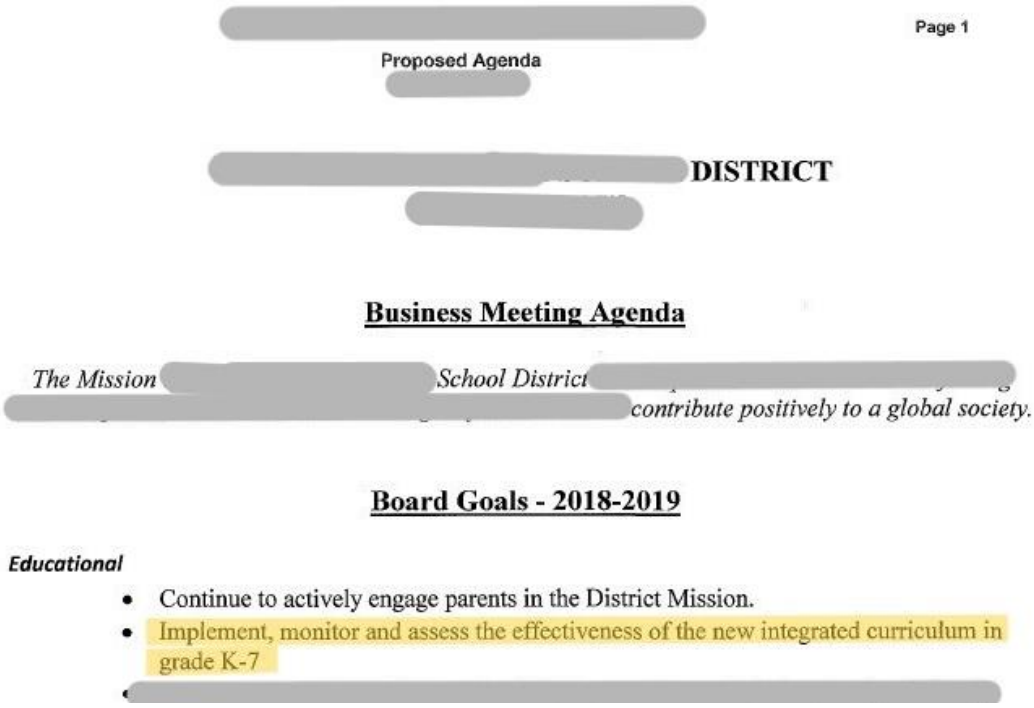


It began with the district level instructional leads working with teacher teams to analyze the commercial curriculums that were currently in use. During the summer of 2018, the district instructional leaders along with teachers from each grade worked together to finalize the integrated curriculum. It was presented to the Board of Education at the August 30, 2018 Board meeting. Once the integrated curriculum was developed, it needed to be closely monitored to ensure it was meeting the needs of the learners. The Board of Education made the implementation, monitoring and assessing the effectivness of the integrated curriculum one of the Boards educational goals for the 2018-2019

school year (see Image 1). Throughout the academic school year the teachers are constantly reflecting on the curriculum. During the summer the teacher feedback is analyzed and determinations are made as to whether the units will be changed.

Image 1

Board of Education Business Meeting Agenda



[redacted] Page 1

Proposed Agenda

[redacted] DISTRICT

[redacted]

Business Meeting Agenda

The Mission [redacted] School District [redacted] contribute positively to a global society.

Board Goals - 2018-2019

Educational

- Continue to actively engage parents in the District Mission.
- Implement, monitor and assess the effectiveness of the new integrated curriculum in grade K-7
- [redacted]

The district decided that this was their opportunity to make the change from purchasing several commerical curriculum for each subject to doing something different that would better meet the needs of the learners they had in front of them. The district knew it would need to be closely monitored and assessed. Sarah the insructional lead said, "the vehicle that drove all of it was the change in the standards. We went from Common Core Learning Standards to the Next Generation Learning Standards." Before the district purchased curriculum aligned to the new standards they decided to analyze

"what we were already doing that worked well" and then aligned it to the new standards while at the same time, "incorporating the science and social studies standards." According to the Instructional Leaders, "We were now able to decide what we wanted to do as a district to align the curriculum with our mission and vision." This included integrating sustainability. It started by deciding the sustainability stands that would be the focus at each grade band (see image 2). The sustainability strands that were to be focused on were first presented by the sustainability planning team (See Figure 8). According to Sarah, the instructional lead, the grade focuses were chosen because they were align with the Next Generation State Standards in science and social studies.

Image 2

Sustainability Strands by Grade Band

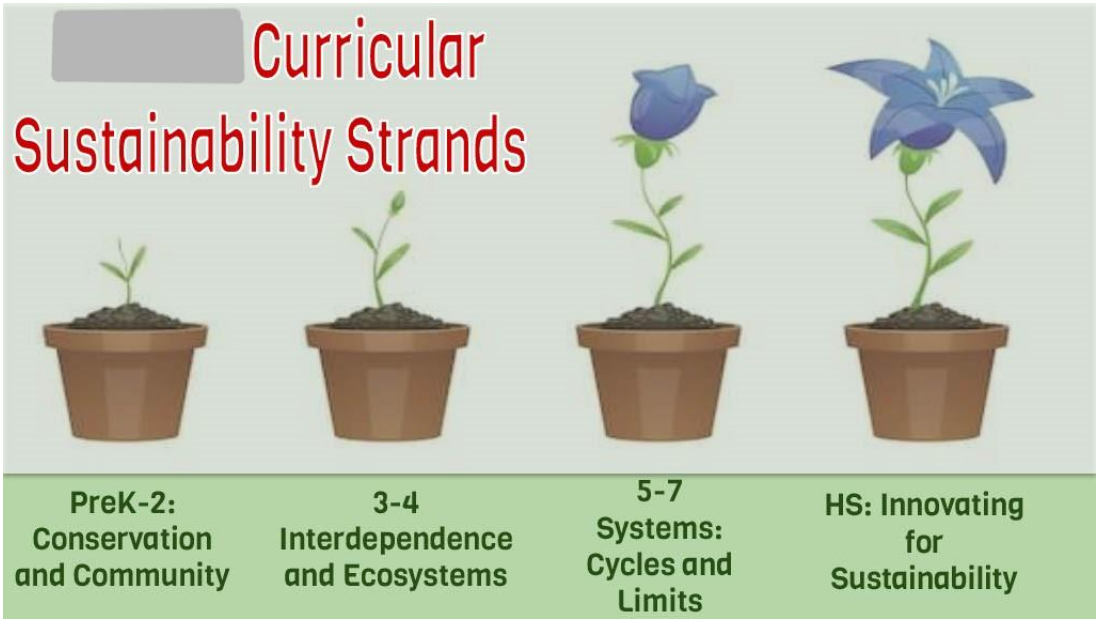
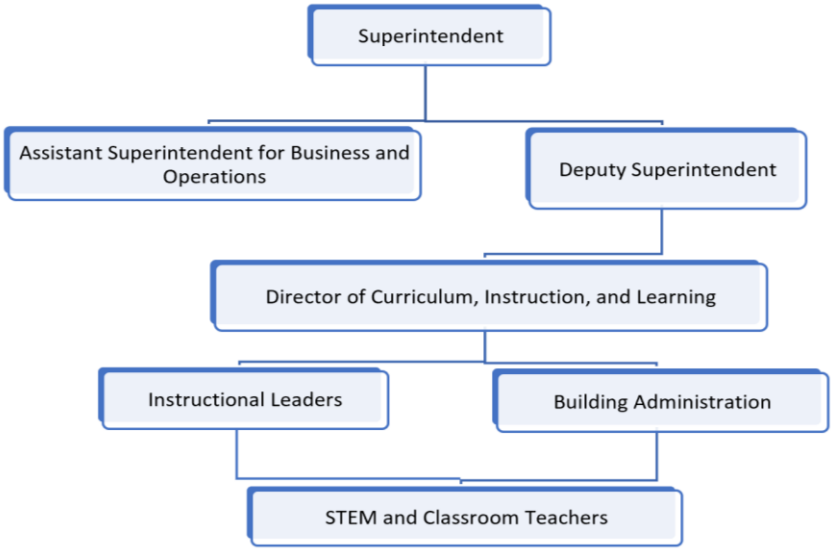


Figure 8

Sustainability Planning Team Organizational Chart



Brianna explained, "The curriculum is written by our district. We don't buy a curriculum and so we're living it and breathing it and then looking at those standards and adapting properly." This was no easy feat. Sarah explained how it took a committee of teachers, administrator, and district instructional leads, "My team literally wrote every single standard on chart paper… around the room and we all sat in the middle and we figured out how they go together." They built on the units that were already successful and working well for the population of students they served in the district.

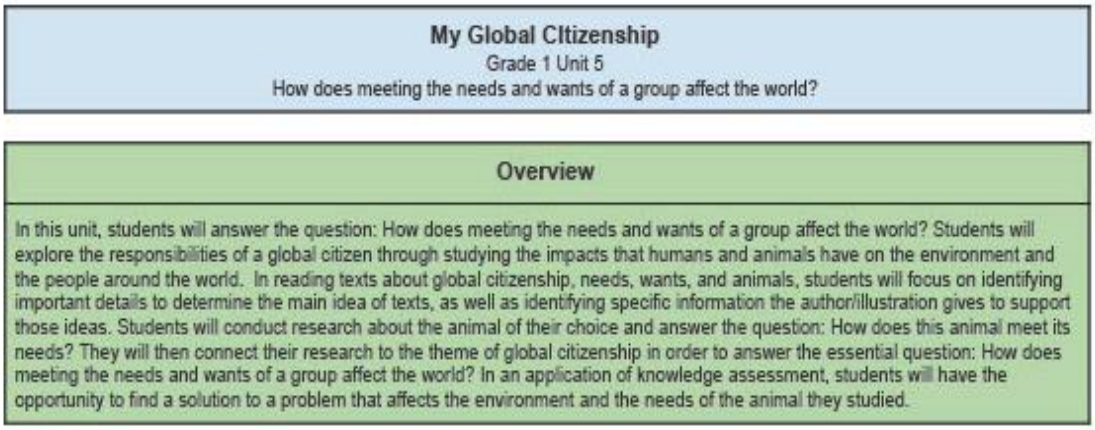
The district curriculum development team created essential questions to guide each unit. Tara the middle school principal said, "The curriculum is driven by content concepts united by an essential question or unifying skills." (See image 3) The students make connections between different topics across content areas and they "showcase what they know". She continued to share, "The district over the past few years has really made a push to be intentional about the interdisciplinary approach and making those

connections." As seen in document 3, the essential question frames the unit. There is an overview that explains the big ideas of the unit. The English Language Arts, Social Studies, and Science standards that are addressed in the unit are listed and are aligned to the essential question.

The district analyzed the standards in all the subject areas to synthesize them. They figured out what standards would work together under the common essential question. By doing this the integrated curriculum was created to solve the problem of not having enough time to address the science and social studies standards.

Image 3

Sample Guiding Question and Unit Overview



My Global CItizenship

Grade 1 Unit 5

How does meeting the needs and wants of a group affect the world?

Overview

In this unit, students will answer the question: How does meeting the needs and wants of a group affect the world? Students will explore the responsibilities of a global citizen through studying the impacts that humans and animals have on the environment and the people around the world. In reading texts about global citizenship, needs, wants, and animals, students will focus on identifying important details to determine the main idea of texts, as well as identifying specific information the author/illustration gives to support those ideas. Students will conduct research about the animal of their choice and answer the question: How does this animal meet its needs? They will then connect their research to the theme of global citizenship in order to answer the essential question: How does meeting the needs and wants of a group affect the world? In an application of knowledge assessment, students will have the opportunity to find a solution to a problem that affects the environment and the needs of the animal they studied.

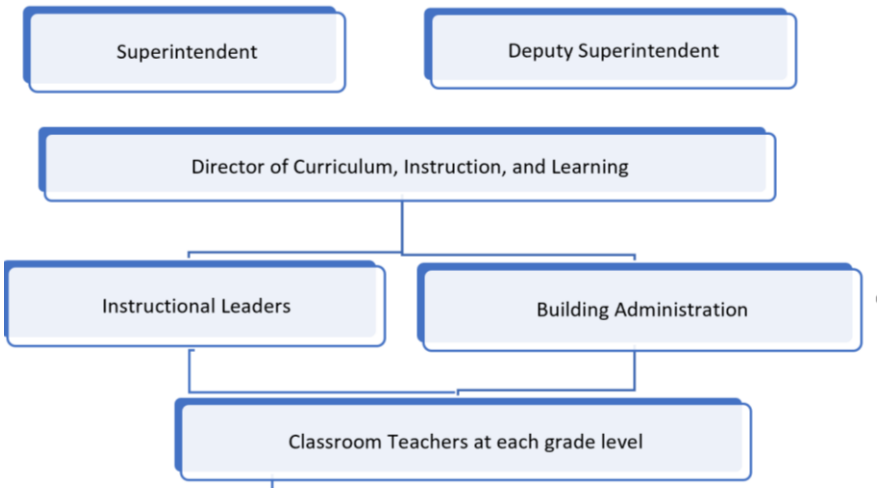
Faculty Collaboration Through Regular Professional Learning Communities. The second sub-theme that emerged regarding planning and preparation of the integrated curriculum from the collected data was consistent faculty collaboration through regular Professional Learning Communities. As a district, members from all levels came together to create the new integrated curriculum (see Figure 9). The feedback from teachers and administrators were used to decide what they wanted to keep

from the former curriculum to create the new integrated curriculum. Tara said, “So many people were involved at the district level and also at the building level. We have different structures in place to actually have some distributed and shared leadership throughout the buildings.”

Sarah, an instructional leader said, “It started first with the teachers telling us what their greatest lessons were, the greatest units, and things that they've done that they felt were most effective for children.” Then the leaders continued the work. Sarah continued, “The building administrators and the district leaders sat together and made overviews- How is it going together?- How could this potentially work?” Once there was a plan developed, Sarah continued, “We started having teacher teams… work over the summers and put it all together, having the teachers write all the lessons. (They) figured out if it makes sense or if something needed to be moved because they're the ones teaching it.” Through collaboration as a district, the integrated curriculum began to form.

Figure 9

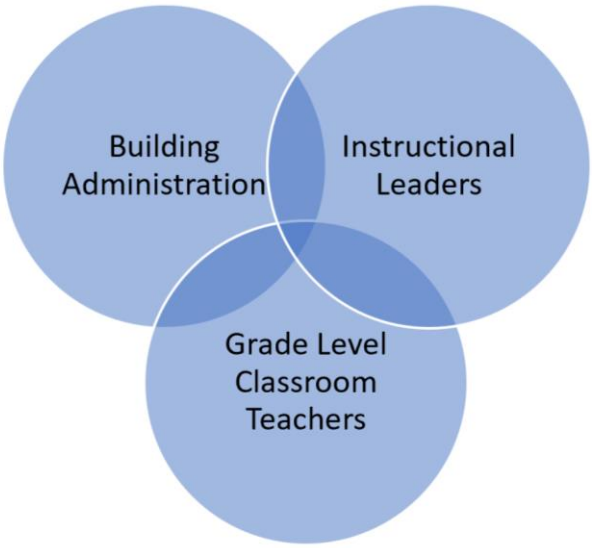
Integrated Curriculum Planning Team Organizational Chart



Professional Learning Communities (PLCs) are a practice used in the district. They meet once in every six day cycle. Sarah said, “The purpose of the PLCs that the district invested a lot in, is for teacher leaders to have common assessments to look at student work in order to support all students.” The PLCs consist of teacher teams, administrators, and instructional leaders (See Figure 10). This time is used productively to analyze student work, assessment data, and the curriculum to determine what needs to be added or tweaked for the following year. Brianna said, “We meet and we go over our curriculum and what we've delivered already and then we take notes on what did and didn't work.” Cara stated, “At our weekly PLC's we constantly talk about the units.” Later Cara said, “We are constantly collaborating… we planned together weekly for the upcoming cycle and the 2nd grade team also works well, really well together and with Rebecca (the STEM teacher).

Figure 10

Faculty Participants in Professional Learning Communities



In addtion to the formalized collaboration of PLCs, teachers are constantly discussing their activities “on the fly”. The enrichement teachers, including STEM teacher Rebecca is not part of the traditional PLC. She shared that even though she isn’t scheduled to meet with the classroom teachers as a team she, “push(es) in to their PD” to align what she is doing with where the students are with their homeroom teachers and to “offer support and resources.” She said that she touches base with them informally as much as possible but “everything is written in the integrated curriculum” so she knows where the classes are and what is being covered and how her program can enhance the learning they are doing. She “would love to be a part of each grade levels PLCs… but there's only so much time.”

Through the work with the instructional leaders, the administration, and the teacher teams, the curriculum was created and continues to evolve. This collaborative analysis of curriculum leads into the next theme of the living document.

Living Document. The collaboration during the PLCs is what helps to guide the continuous reflecting on units through a virtual living curriculum document. The curriculum lives as a shared Google Doc. The entire staff in the district has access to it. So even during COVID times when you are not able to be in the same room to plan or if the enrichment teachers aren’t able to join the weekly PLC meetings, they are still able to access the current changes to the curriculum. Brianna stated, “We have Google Docs that we record everything in. Then that will be for our future meetings and/ or the summer curriculum writing.” Cara says, “We're just constantly reflecting like… let's make sure we take this out. This was no longer appropriate, that link doesn't work.” Having this

shared document that is being constantly updated keeps the curriculum current and evolving.

When asked about teacher collaboration, Tara stated, “it was an all hands on deck approach”. The curriculum is “constantly tweaked” through the discussions in the PLCs and then we are updating the integrated curriculum through the Google Doc. “They (the teachers) are analyzing what's being done so I would say there's constant iterations which is actually kind of cool.” The teachers are consistently “developing assessments that are uniform and having a formative assessment and summative assessment.” They share all of their ideas using the online platform.

According to Brianna, the teachers “go over our curriculum and what we've delivered already and then we take notes on what did and didn't work and that's why and how we're always tweaking.” Staff can choose to do curriculum writing over the summer. All of the notes that have been added to the virtual curriculum document are discussed. Sarah said, “Over the summer we ask, “How are you implementing it? Where are the struggles? What are the gaps?” Then the changes are made. It is a process.” She continued, “When lessons are being changed or eliminated, the standards that are being addressed in those lessons need to be covered somewhere else in the curriculum.” Together the summer curriculum writing team decide what is going to happen. Are the standards already addressed somewhere else or do they need to create something new.

Ramona, shared that the teachers are encouraged to have “creativity and flexibility within each unit of study”. She shared that the Google Drive provides

opportunities for them to share new ideas to embed into lessons and units and its always "met with encouragement".

The shared document allows anyone to make changes or notes on the curriculum document that other staff can see. It can be looked at and analyzed during the summer planning when there is more time to discuss the decisions to update the changes. The adjustments can be assessed during summer planning to determine if it is a permanent change that the team wants to make.

Sofia a kindergarten teacher with over 25 years of teaching experience said, "as a school we constantly review it (the curriculum) and we make changes that need be made." Sofia is on the summer curriculum planning committee where she along with other teacheres and administrators, "look over the kindergarten curriculum… as time goes on certain things don't work well; we need more or less… we decide on the changes." She shared that the staff is, "always consciously looking at ways to improve the curriculum to find ways to make it better."

Brianna is a 3rd grade teacher with over 25 years of experience. She is very involved in the curriculum choices and said, "I think as we're living it, breathing it, and then looking at those standards we are able to adapt properly." She said, "We are able to see what works best when we're delivering it (instruction)." She later said, "We would tweak it for the next year… When we have our meeting they might be like, I think we need to add an extra day because one of the teachers did an activity that was great. I think we should make time for it next year." The teachers are able to discuss what worked and didn't and see where they may need to add or take away time from a unit. Brianna continued, "So we may say let's add a day in our lessons for something like that

activity." Informal conversations and formal PLCs lead to curriculum decisions that are then finalized in the summer curriculum writing teams.

Through constant reflections both formally and informally, the integrated curriculum continues to evolve. The teachers are able to utilize current technology to share and record their ideas to make improvements to the curriculum for the following year. Together, the three sub-themes, standards, collaboration, and reflections encompass the administrators' and the teachers' perceptions towards planning and preparation of the integrated curriculum.

Theme 2: Integration of Systemwide Sustainability Practices

The second overarching theme that emerged during the analysis of the collected data was the integration of systemwide sustainability practices within the district. This includes the overarching ideas of sustainability: environmental, social equity, and economic vitality. The three sub-themes include ongoing infrastructure improvements throughout the district, embedding sustainable practices into instruction across all content areas, and engaging with the wider community to bring awareness through collections. Each of the participants shared their views on where they see the overarching ideas of sustainability at the district and building level. In addition to the interviews, documents from the district's sustainability committee meetings, social media posts, and curriculum overviews were analyzed. The district is making great efforts to address and embed the three overarching ideas of sustainability by making infrastructure and curricular improvements. The overarching ideas of sustainability have overlapping components. The analysis of the sub-themes demonstrate how the district is working to embed the

sustainability initiatives through infrastructure, instruction, and community awareness and collections.

Infrastructure Improvements to Support the Integrated Curriculum. Building the infrastructure paves the way for integrating environmental sustainability practices. Students are engaged with and caring for their local environment using the school grounds and the local community. This connects students to the real-world problems that affect them. The Morris School District has previously made and continues to make infrastructure improvements. Tara, the middle school principal shared, "the administrators are very much a community of learners… we've been talking about what sustainability looks like not just in the curriculum but also the internal facilities and structures in our building."

The district has a sustainability committee that includes the assistant superintendent, administration from the buildings, the instructional leaders, and the STEM teachers. The team comes together to make decisions about how to better integrate sustainability into all aspects of the school district. This includes infrastructure at the district and building level, curriculum integration and through clubs. The team received professional development from Children's Environmental Literacy Foundation (CELF) (see image 4). CELF is an outside organization that focuses on Education for Sustainability. The district contracted with CELF for a staff development series of mini workshops which included "The Foundations of Education for Sustainability", "Integrating the Big Ideas of Sustainability in the Curriculum", and "Your Campus, Your Classroom". Throughout the staff development, the participants were involved in analysis of the district facilities and the curriculum to determine the highest leverage

areas. With the assistance of the staff developers from CELF the Morris staff was trained in how to look at the curriculum with a sustainability lens. They toured the facilities together to determine the next steps for improvements.

Image 4

CELF Professional Development with Morris School District Faculty

Throughout the training the district's sustainability team was immersed in the essential concepts behind Education for Sustainability. They engaged in learning experiences to gain understanding, connect, extend, and apply sustainable practices throughout the curriculum and the school facilities.

Georgia, one of the elementary school principals recalled her experience with CELF explaining that the team conducted a "walkthrough in each of our buildings to look at what we currently have… and then talked about some of the future projects that we

wanted to do." She shared some of the projects that the district was working on to improve the infrastructure, stating, "We're doing a lot of construction but one of the things that we are going to do is have an outdoor learning space to extend the STEM classroom." By creating an outdoor space that is attached to the STEM classroom it will allow Diane, the STEM teacher to provide opportunities for the students to make connections between the learning they do in the classroom with real world experiances outside.

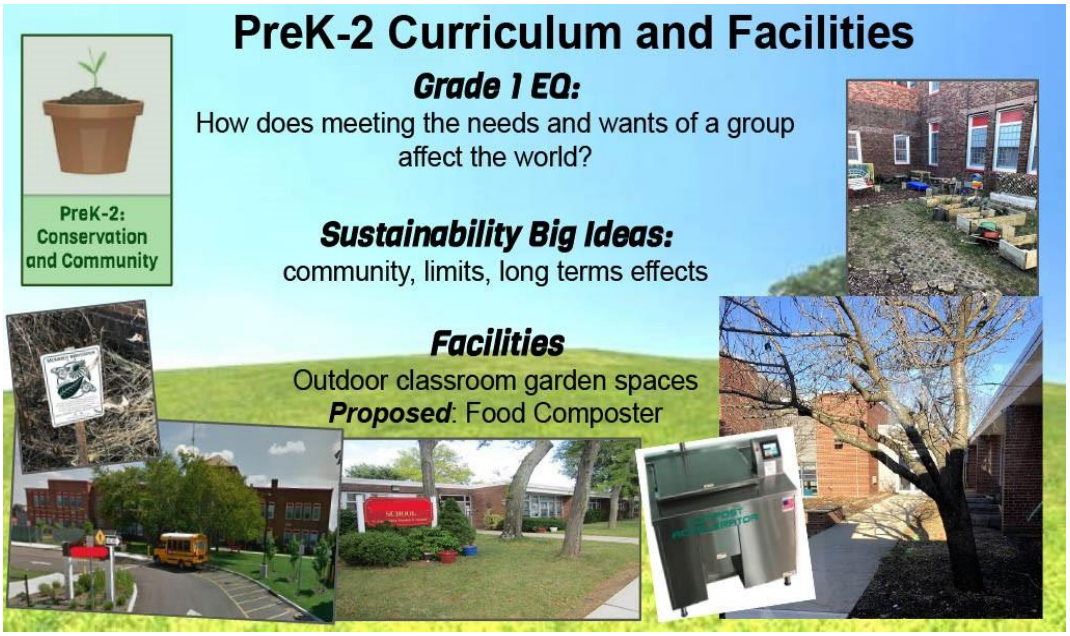
Sarah spoke about the previously completed and futue capital improvements around the district. She shared, "our STEM teachers wanted learning gardens so we (the district leaders) gave it to them." Each of the schools have outdoor learning spaces that continue to be updated to meet the needs of the teachers and the learners to enhance the curriculum. In addition to the outdoor classrooms, the elementary schools "added composters and plan to build a pond in the outdoor learning space for ecological studies." (see image 5).

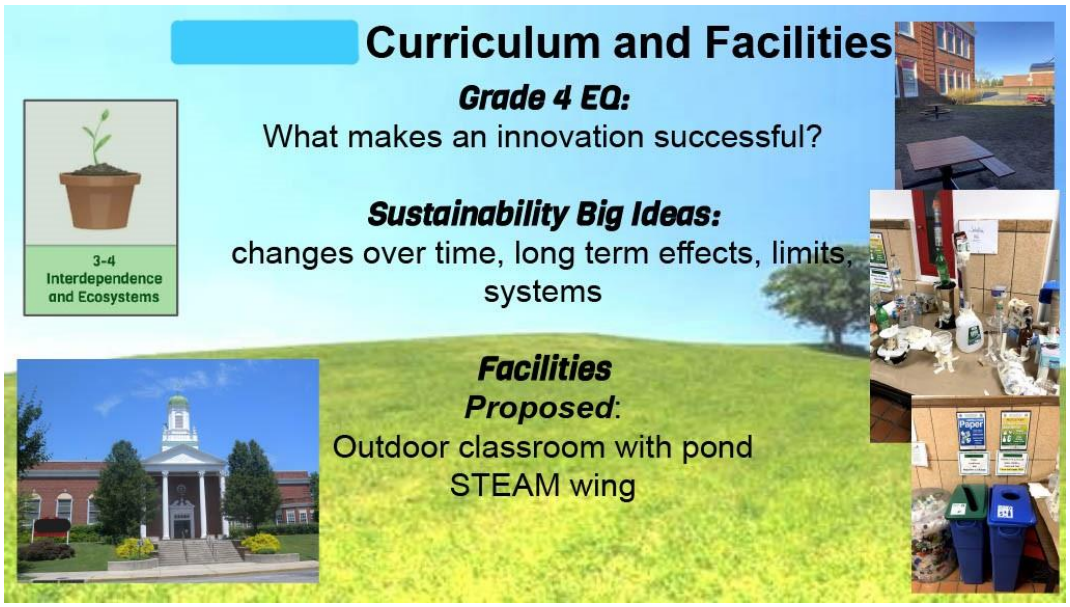
She further shares that "the middle and high schools have greenhouses and the highschool plans on adding a rooftop garden and solar panels." Sara said, "The last thing to do to bring it all together was to create a pollinator pathway." She explained how the pollinator pathway was a way of connecting all of the schools. As part of the district's facilities sustainability plan it was decided to create pollinator gardens at each of the schools sites. The goal of pollinator pathways is to provide pollinating insects and birds nutrition and habitats. They are pesticide-free green spaces of native plants that provide refuge for living things passing through or living in the community. Due to the use of pesticides and land development, there are limited areas that provide healthy habitats for

many pollinators endangering their existence. Even the smallest green spaces, like flower boxes and curb strips, can be part of a pathway so the districts initiative of planting native pollinator gardens has a positive impact on the environment.

Image 5

Infrastructure Improvements Aligned to the Curriculum





Tara, the Middle School principal explained how they "have a greenhouse that the students work in" but she was really excited to share the plan for the addition of a honeybees hive. It would go on the walls and is interconnected. The honeybees would be seen from the inside of the building and it would provide a refuge for them. The honeybees would be able to pollinate the native gardens on the campus. All of the improvements that were done or are planned provide place-based learning opportunities, enhance the curriculum, and improving the local environment (see image 6).

Image 6

Middle School Infrastructure Improvements Aligned to the Curriculum

Tara, the middle school principal added, "the district did an electricity audit and replaced light bulbs and we're doing a whole rework of all of the internal systems in our buildings." She shared that the "building is almost 100 years old… it has to be updated… we're going to update it right." To get the students involved, the middle school STEM teacher involved the students by having them conduct energy audits. The students

measured energy consumption to determine the types of improvements that could be made to the building's infrastructure and changes to human behavior.

The Morris School District has made it a priority to make sustainable infrastructure changes to enhance the curriculum and instruction. The changes that were previously made and the proposed changes have made environmental improvements while giving the students hands-on, real-life world experiances. The school buildings and grounds have added to the students learning experiences.

The Morris School District has some infrastructure in place that allows it to connect their units of study to the real world using their school buildings and grounds. This was all done purposefully. Sara explained, "A scope and sequence overview starting with the little ones and building up is tied to facilities." The curriculum is designed "for certain units to use the greenhouse and units are going to have students doing the composting." She added, "We plan for, where in the curriculum and how the facilities are going to tie into what you're doing." Sara explained that the facilities are not only tied to the STEM curriculum but, "we can make connections to social studies or even we can be talking about opinion writing and we can use the facilities."

Through the ongoing upgrades to the infrustructure the district makes it a priority to think about and incorporate sustainable practices continuously connecting the building infrustructure improvements with curriculum integration.

Embedding Sustainable Practices into Instruction Across All Content Areas. At each grade level there is at least one unit that has a focus on sustainability. When the unit is not focused on sustainability, it still has sustainability practices embedded. According to Sarah, "There is an essential question (see image 7)… it became a vehicle

Image 7

Integrated Curriculum Essential Questions

to do everything else like sustainability and growth mindset… The essential question is the vehicle to have it all cohesive and work." The majority of the essential questions infuse the big ideas of sustainability. Rebecca said, "It (sustainability) is really embedded in our curriculum more than we even realized… We weren't necessarily calling it sustainability but we were teaching the practices and the thinking behind it." There are further steps that need to be taken to make it even clearers for the teachers and the students. It has to be throughout everything we do, but in a meaningful way. Rebecca

continued, “More recently through the sustainability committee’s work we are identifying the practices as sustainability themed. This is still a work in progress.”

When Rachel, an elementary STEM teacher was asked about where she sees sustainability, she said, “in order to really feel this you have to live it everywhere. It can't be lived in isolation.” There are many topics throughout each grade’s units of study with a sustainability focus. According to Rachel, “The units from one grade to the next build on each other.” The STEM teachers try to align their units with the units from the integrated curriculum. For example, Rachel said, “ 2nd grade starts to discover biodiversity and this is right on the heels of them researching a habitat with their classroom teacher.” (See image 8)

Image 8

Students Surveying the Schoolyard Through the Lens of Biodiversity

She has the students “exploring of all the different habitats and then they become somewhat of an expert on one.” The social studies standards address the community and how it has changed overtime. Rachel said, “We explore our commmunity by going to the field that we have right behind our school and we collect data on how much biodiversity is there. Then make inferences about how it has changed overtime.” She works with the students to understand what this community was like fifty, one hundred, and one thousand years ago. This work and research leads to the project that stretches across grades, involving quail.

Rachel explained that the district participates in a quail restoration project. The number of quail on Long Island dramatically decreased due to human activity. The students on each grade play a different role but everyone gets involved in the quail project. “Kindergarten explores what animals need to survive. They create a temporary habitat for the quail after they hatch.” She continues, “First grade is exploring life cycles of different animals and so one of the life cycles they'll discover is the life cycle of the quail.” She then shared that the second graders, “learn about the adaptations of the quail and how they survived in this particular habitat.” (See image 9)

All of the students care for the quail until they “grow to be large enough to be reintroduced into their natural habitat.” This project helps students to gain a deeper understanding of the changes that have taken place across Long Island and how human activity can have negative consequences on the environment. The students learn what they can do to prevent further distruction to the environment.

Image 9

Students Engaged with the Quail Reintroduction Project

Through the quail project and STEM class, the students at all grade levels get involved. Many of the themes of environmental sustainability are embedded. The students build on their understanding of different topics from grade to grade and across content area. The concepts the students learn in their classrooms are reinforced through the enrichment programs and vice versa.

One of the three big ideas of sustainability is economic vitality. Topics around economics are introduced and integrated into the curriculum as early as kindergarten. Sofia, a kindergarten teacher discussed this area of sustainability. She shared, "We talk about money. We incorporate what you need and what you want… We talk about jobs and banks and the cost of living." At first she thought that this would be difficult for such young children to understand but through the work with the students she recalled a

discussion that the class was having about meeting their basic needs. She shared, "The little ones understood that there is a limited amount of resources on the planet and they needed to be shared by everyone. If some people take too much there isn't enough for others." Sofia was blown away by the connections that the students were making.

In second grade, Cara talks about one of her favorite units with the theme of interdependence. Through this unit, she is able to incorporate all three big ideas of sustainabilty under a common theme. She shares, "The science component is food webs and food chains. The children start by learning about herbivores, carnivores, omnivores. They start to learn about food webs and food chains." The students do projects by creating their own food webs and food chains. "They then learn how if one animal is taken out of that food web how it will no longer survive as a food web or food chain because of how interdependent these animals and plants are on one another." Then Cara explained how they transition from animal interdependence to economics. "The kids get paid a fake $100 bill. Then they learn about taxes and then they're taxed for being part of Morris School District, for being part of Mayfield school, and for being part of the classroom. We talked to them about federal, state, and local tax." Cara creates a classroom economy. "They (the students) have different classroom jobs… they get paid… but then they use the pencil sharpener (and have to) pay for that service. They learn how interdependent they are."

Georgia, one of the building principals shared with me that her 3rd and 4th graders focus on a "Call for Action". She explains how the 3rd graders "focus on local citizenship and explore water and access to water around the world and people's access to clean water and conservation." The 4th grade unit is about being changemakers. "They talk

about factors that are leading to global warming." Georgia explains that, "We focus on issues important to New York in 3rd grade and global problems in 4th grade. The students do research and do a Call for Change." The students have a lot of choice when they are doing this project. They choose a topic that they are patiionate about. Georgia continues, "They ask themselves, 'What can we do to solve this issue?' Some topics that came up were climate change and food shortage… They do a lot of research and marketing in the school building and talk to their peers about sustainability."

During the Focus Group discussion, the 3rd grade teachers shared their experience with their persuasive writing unit in which students get to choose a passion of theirs that they would like to make a claim and persuade people to believe in what they believe in. They shared, "A lot of time students will write about recycling, water conservation, or water pollution. They try to convince people to recycle and try to convince people to make changes, like cleaning up the ocean." (see image 10)

Image 10

Students Presenting Call for Change Projects During Genius Hour

Integration of all three pillars of sustainablity are embedded into the curriculum throughout the grades and throughout the disciplines. Students at all ages are able to apply the sustainability themes of environment, social equity, and economic vitality through the district's integrated curriculum.

Strengthen the School-Community Connection. Integrating sustainability into the curriculum and at the school building allows for there to be a home-school connection. By making families aware of school collections, they are able to be involved. Collections bring awareness to all three branches of sustainability: environmental integrity, social equity, and economic vitality. The Morris School Districts has multiple collections throughout the year run by staff and students to bring community awareness to important issues.

Kelly, a kindergarten teacher, told me about the crayon and marker collection at school. "We have a gigantic box in the front of the lobby that is filled with broken crayons… the children love it… We do the same thing with the plastic markers when they're not working anymore." The school district participates in Color Cycle, a recylcing program for markers and crayons.

Kelly continued to talk about other collections at school saying, "We keep seeds from anything that they've grown. We save them to be able to replant. I usually send home a Father's Day gift from the seeds… like a tomato plant or a started sunflower." The growing of the seeds have many purposes, "We learn about life cycles, integrate math as we track the growth, and we make a connection with the families. One little boy had to climb on his father's ladder to show me how tall the sunflower got."

Second grade students particiapte in a yearlong recycling project to give back to the community. Each week the second graders collect all of the recyclables that can be returned for the five cent deposit. Families volunteer to pick up the recyclables every Friday. They go with the child to make the returns. The money that is collected is used to purchase food for a local food bank. The second grade classes go the the grocery store to purchase the food. Then the classes go to the food bank to organize all of the food on the shelves for the families in need in the local community. Activities like this help the students understand the whole cycle while also including the larger community.

Tara, the middle school principal in the district explains about some of the sustainability themed clubs the district has, "We have a Community Action club as well as an Environmental club. We have a Greenhouse club and a gardening club. There are students that definitely take an interest in recycling and caring for the environment." She then explains about the recent E-waste collection the school held (see image 11). "for the past five years we partner with a local company. They donate a dumpster… They are able to take the E-waste off of our hands so that district makes a concerted effort to donate the electronic waste and we also publicize it to the community." The E-waste drive is publisized by the student groups. "They hang up signs, read, write, and debate about the topic of recylcing and make public service announcements."

Image 11

E-waste Collection

In addition to the annual E-waste collection at the middle school, there is an ongoing battery collection in the buildings. Brianna a third grade teacher and a parent of high school students in the district said, “I’m becoming more aware, especially because of my boys that are in the district. It is a very conscious effort of mine to do the right thing.” She shared her experience with the collections. “We had a big TV that didn't work. I was ready to throw it out. My boys put it under the stairs waiting for the collection.” On another occation, “I was about to throw out batteries. My 14 year old reminded me to recycle them in Mrs. Diane’s bucket. That cannot go in our Earth.” The collections at school help to inform the families and change the habits of the larger community.

Tara, the middle school principal shared what she observed during the E-waste drive. “Car after car pulled up loading TVs, monitors, old computer brains into the big dumpster.” Brianna said, “I share my experiances with my students. You're not just

telling them but you're actually showing them that you're living it. It was really great… and I feel rewarded inside my own heart."

Throughout the year, the district has food drives, pajama drives, and around the holidays a toy drive and a giving tree (see image 12). Sofia told me about how it was incorporated into her needs and wants unit. She talks to the students about saving money in order to meet your needs but even when families work hard sometimes, they need a little help. She said, "We explain to the children that it is important if you have the money or if you want to you can bring in something for people who are less fortunate than us." She shared that there are families within the district and in the community that are in need. The schools incorporate economic sustainability into our curriculum which provides educational opportunities for students to have empathy for others and to encourge the students to help which instills, "helping other people makes them feel good about themselves."

Sofia continued to talk about bringing awareness to the students and making connections to what they are doing in school with the families. She said, "I don't know if they (the kindergarteners) actually understanding it because some of them never experienced it. Meanwhile the children sitting right next to them could be the family struggling."

Image 12

Students Donating the Food Collected to a Local Pantry.

One of the STEM teachers, Diane said, “Years ago the schools didn’t recycle. The students were passionate about the Earth and didn’t understand why, so my students and I wrote letters… we ended up getting recycling into the building so we do have paper recycling here.” Diane is a huge advocate for sustainability for the school. As mentioned previously by Brianna, she instills in the the students the importance of taking care of the planet and disposing of things properly. The students go home and hold their parents accountable.

The collections the school district hold allow the families to be involved in their children’s learning. It reinforces the home-school connection and gives the students an opportunity to be involved in the sustainability initiatives at the school.

Theme 3- Teachers' Reflection on the Experience of Teaching a Sustainability-Themed Curriculum

Throughout the interviews, participants shared their experience teaching the sustainability themed curriculum. They shared how they perceived their students while

they were involved in sustainability themed activities. The participants shared challenges they faced, their own changing views, and their students' high level of engagement. Participants would continuously share how excited their students were when involved in a variety of activities related to sustainability. Two subcategories emerged being, challenges to student collaboration and enhanced student engagement opportunities through hands-on activities and place-based learning. These subcategories are what the participants perceived to help sustainability themed activities to be highly engaging.

All the participants interviewed were in favor of the integrated curriculum although one of the more senior teachers was reluctant about it when the idea was first introduced. Kelly, an educator for over 30 years stated, "I think sometimes when things are first presented to us, especially in early childhood, I'm going to be honest, sometimes my reaction is hold on everybody. I want to teach them to read. I want them to be readers." After the first year she did see the benefits of it, stating, "…it became a much richer curriculum… the things kindergarten students are doing, I would never have imagined their little brains could encompass… my overall opinion on how we integrate, I think it's wonderful, I think it is a higher level of achievement." Change is difficult for many people but through the support of the instructional leaders and the administration, the staff was able to see the benefits of the change.

Challenges to Collaboration. COVID protocols changed the way many activities were done this year, especially when it came to student collaboration. The participants shared their experiences and perspectives based on this year and from past years. They did this in order to give the researcher a full picture of the activities that take place in their classroom and school. Even with social distancing guidelines in place, the

participants that were interviewed shared their belief in the benefit of student collaboration. They shared that the students collaborated differently this year through the use of technology and discussion rather than hands on collaboration.

Diane, a STEM teacher when referring to her room said, “It's the noisy room--good noise. I have round tables which is conducive to group work. Everything in the lab is group work. There is no individual work. Most of the time they're talking and working together on their assignments.” She went on to discuss how this year created many challenges because of the collaborative nature of her program. “In the past, the students always worked with shared materials.” This year the enrichment teachers push into classrooms instead of them visiting the lab and the students aren’t allowed to share their supplies. Diane explained how she had to modify the curriculum this year because of the COVID-19 safety protocols, “I don't have enough kits to hand out for everybody. Usually we use kits that are shared with groups of three to six kids depending on the activity but this year I can’t really do that. I had to change the way I did activites with them.”

Rachel an early elementary STEM teacher said, “My program is really based on collaboration and working together and problem solving. Rarely do I encourage them to work by themselves.” She elaborated by saying, “I really encourage them to work with their peers to collaborate, which makes my lessons, I would say, it’s a high level of engagement and as hands on as possible.”

Ramona, a kindergarten teacher gave an example of how even with social distancing the students worked together excitedly sharing their discoveries. She shared her experience with a spring scavenger hunt she had created for the students. They

explored the school yard gardens (see image 13). She said, “they were able to talk and share things that they noticed… on the scavenger hunt and they noticed an animal, or spring environmental changes. They want to help each other notice things… they can collaborate through discussion.”

Image 13

Students Working Collaboratively to Explore the School Garden

Kelly, another kindergarten teacher shared about her plant unit. She explained about their experience taking the students outside to do their planting and then once the plants were brought inside to track the plant growth. Kelly said, “They were very much interested in how each other's plants were growing. We kept them in the classroom, I would say for about three or four days before they brought them home… I could feel the excitement.”

Even though the student collaboration looked different this year, the students were still able to build off the ideas of each other and learn from one another through

discussion. The participating teachers all found that sustainability themed activities are highly engaging partly because of their collaborative nature.

Enhanced Student Engagement Opportunities Through Hands-On Activities and Place-Based Learning. Many of the sustainability themed activities that the participants described in their interviews involved hands-on components or placed based learning. The participants shared that the sustainability themed lessons lend themselves easily to bringing the students out into the local community to deepen their understanding and to apply their learning. The activities involved topics such as energy, water, conservation, interdependence, biodiversity, cycles, plants, and animals. The participants attributed the enhanced level of student engagement to the topics of the sustainability themed lessons and units.

Rachel, a STEM teacher shared how students that cycle through her enrichment program participate in many hands-on activities. "We are finding ways to plant native seeds in a native species garden to increase the biodiversity in that area." She explained about the project to reintroduction quail to Long Island. "We're raising quail eggs and we're talking about the adaptations of the quail and how they survived in this particular habitat." These activities allow the students to learn about biodiversity and get involved in increasing the biodiversity in our local community. "The students build temporary habitat for the quails. After they hatch, they can grow and be large enough so that they can be reintroduced into their natural habitat." (see image 14)

Image 14

Quail in the Student Built Habitats

Diane shared her experience with the students experimenting with ways to prevent erosion by building models (see image 15). "They work in partnerships or groups. They plan out their models, build them, and then test them. It helps the students understand how land changes overtime. The students learn about humans impact on the Earth and what we can to slow down erosion."

Image 15

Students Building and Testing Erosion Models

The the quail reintroduction program and the erosion project are a couple of examples of students in the early childhood grades involved in learning the science and sustainability concepts through hands on activities. The participants percieved the student as highly engaged duing these learning opportunities.

Grace, an upper elementary school teacher shared how the students worked in the Fab-Lab. “They did experimenting with renewable energy and solar energy.” The Fab-Lab is a fabrication laboratory that has different machinery and technology that the students are able to use to create and build hands on projects. Grace worked in collaboration with the librarian to create challenges that were about renewable energy. “We created a Pixel Art ocean challenge. It was teaching students to protect the ocean.” She also created “challenges to create something using upcycled materials that could be used to create a device that could clean up the ocean.”

There are Fab-Labs and Makerspaces in each of the buildings. This demonstrates the district's priority around hands-on learning. Students are given opportunities to construct their ideas through the use of technology and the materials and tools availible to them in the makerspaces.

Throughout the integrated curriculum teachers take their students out of the classroom to deepen their understanding of concepts being taught. Through place-based learning opportunities, the students are using their school grounds and local community to learn about sustainability initiatives that are embedded into the curriculum. The Morris School District has previously made and continued to make infrastructure improvements to allow for place-based learning on their campuses. The schools in the district have learning gardens that house native plants and outdoor learning areas. Sarah an instructional leader for the district said, "The teachers are outside in the learning gardens with the students, you know really digging and planting and creating…"

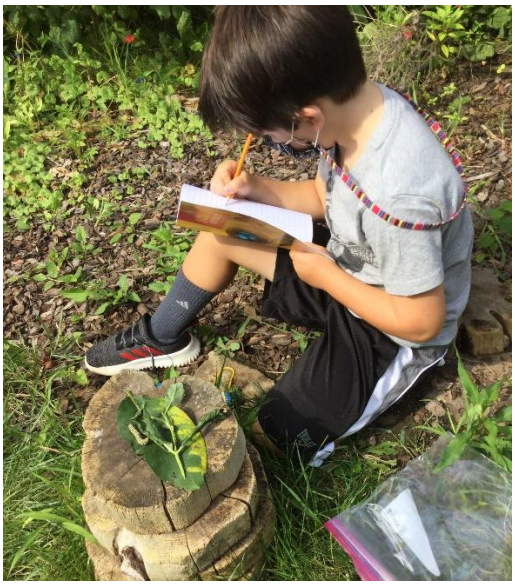
Tara, a building principal shared, "as a district we had a lot of momentum around creating a pollinator pathway between the elementary buildings and the middle school." (see images 16 and 17). The district gardens were designated as Pollinator Pathways by the National Wildlife Federation. In order to be designated a Schoolyard Habitat by the National Wildlife Federation, your school garden must provide food, water, shelter, and a place to raise young. It should be a place of learning and nature exploration for students and a haven for wildlife. The Morris School District has successfully created these spaces.

Image 16

National Wildlife Federation Schoolyard Habitat

Image 17

Student Observing a Monarch Butterfly Caterpiller and Milkweed



Last year Tara researched internal beehives… “they almost look like shadow boxes that are in the shape of hexagons that are put together to look like a big hive…” Tara shared, “We were thinking about this whole ecosystem that we could create in the district… we are always looking for ways we can positivlely contribute to the environment.” Rebecca discussed the learning garden and the first grade unit involving pollinators. She stated, “Every class has an outdoor literacy block, and they are encouraged to go outside (into the learning garden). We have a pollinator garden. The students write to different nurseries and they asked them to donate some pollinator plants.” Each of the schools have pollinator gardens that were specifically designed with native plants which together create a pollinator path that attracts the bees and hummingbirds and the butterflies (see image 18).

Image 18

Students Working in the Native Plant Garden

Rebecca also shared the 2nd grade yearlong sustainability initiative called "Operation Splash" which provides students with place-based learning opportunities (see images 19 and 20). She said, "We become citizen-scientists. We adopt a local storm drain. We visit the storm drain each month and we tally the amount of garbage we see there." Through this project the students are using multidiciplines to track the garbage and then they come up with plans to teach others how to protect the waterway. "We learn what's going to happen when the garbage goes down the storm drain... which then leads to the bay… and it effects all of these marine life. Animals will consume that and then what will happen?" At the end of the unit the classes take a field trip to Freeport where the Operation Splash Team presents more information which gives the students and even deeper understanding.

Image 19

Operation Splash Storm Drain Observations

Image 20

Trip to Operation Splash in Freeport

Brianna shared her experience with the 3rd grade unit themed, "What Makes One a Global Citizen?" (see image 21). The unit consists of investigations through case studies regarding the issue of water access. The students participate in a *Walk for Water*. "We traveled the world virtually by finding out where there is a lack of access to clean water and food. We learn about the water cycle and water access." The *Walk for Water* is to simulate the distance the children had to walk in the particular countries that the students learned about. Brianna continued, "At the end, the students do the math and we donate all of the food and water we collect to a local pantry." This unit stands out to Brianna as a great example to how the integrated curriculum has sustainabilty as a key focus for the students to truly understand the unequalities in the world. They use the school yard to conduct the *Walk for Water*. Brianna shared, "This unit brings awareness

to our students, of the lack of access both locally and globally." The Application of Knowledge is a demonstration of the students becoming advocates for a cause they believe in.

Image 21

3rd Grade Unit Overview- What Makes One a Global Citizen?

This unit of study encompasses social studies, science, English Language Arts, and math while at the same time incorporated social emotional learning and sustainability. It builds on a previous unit called "How does location in the world support survival?" This unit builds a conceptual understanding of the world's biomes, animal and plant life cycles, and animal adaptations. Through literature, the students travel the world researching Earth's climate systems, biomes, and how organisms adapt to living in these places. They learn about the characteristics of organisms living here as well as the obstacles that they face. The students are able to use the school grounds to deepen their understanding and engage in their learning.

Teachers have made connections with multiple community organizations to enhance the curriculum by engaging in many community-based projects to bring awareness to local environmental problems. Kelly, a kindergarten teacher said, "The curriculum is rather rigorous and I like the fact that so much of that is hands-on. I love the fact that the children's level of interest is high." She added that they study "the world in which they live, so it captures their need for exploration. We like to get out of the classroom and into the community."

The students in the upper elemantary grades also use the local community to create service announcements on choice topics. According to Grace, "We gave the students a couple of weeks and they had to work on their public service announcements based on what the requirements were from the (PSEG- Long Island Electric Company) competition." She shared how the classrrom teachers and the enrichment teacher collaborated to incorporate sustainability themed lessons to build background. She explained how it worked. She stated, "We did a whole lesson on recycling and renewable energy." Then the students use their knowledge to compete in community based contests.

Even in COVID times when most field trips were not an option the teachers and administration were able to plan virtual field trips. Francis and Georgia explained about a virtual field trip. "We partnered with an animal sanctuary. We did a whole series for students. They would cycle in with the librarian and took a virtual field trip… We talked about the little things that we can do to help the environment."

Georgia and Tara, both principals spoke about their passion and the teachers' passion for sustainability. Georgia said, "There are many classroom teachers that have a

passion for it. I think everyone thinks is important of course, but you always have a group of people that are really passionate about it." Tara said, "It is something that the district really commits to and is interested in exploring more. It starts as a passion project then it becomes more. We see the benefit it has for the school community and it happens because of the support of the district."

Within all of the buildings, the administrators, instructional leaders, STEM teachers, and classroom teachers believed in the importance of embedding sustainability throughout the integrated curriculum. Through this collaborative work amongst the staff, the themes of sustainability are within all of the units in the curriculum.

Summary of Results

Research Question #1

The first research question, what processes are useful for embedding sustainability into an integrated curriculum is answered by first understanding what led to the district creating the integrated curriculum. Due to the change of the standards from Common Core Learning Standards to the Next Generation Learning Standards, the district analyzed their options to determine what would be the best curriculum for the district to adopt. Through shared leadership, the decision to create their own integrated curriculum was made. The district worked to embed its key values including sustainability into the integrated curriculum. The teachers and administrators felt that this newly developed curriculum truly reflected the best practices that they believe could meet the needs of the students that they served in the district.

There were key players and a supportive leadership team, an open, reflective staff, and an always evolving curriculum. Teachers meet regularly in professional learning

communities to improve the curriculum. They continuously reflected on current practices through their Google Doc. The district partnered with an outside agency to support the district's needs around sustainability. This included site visits in which the agency conducted audits of each building in the district, looking at both infrastructure and instruction. They provided professional development tailored to meet the needs of the district.

Once implementing the new integrated curriculum, the teachers quickly learned that it was a beneficial time saver. The teachers were able to address the science and social studies standards through the integrated literacy program. They were able to keep up with the pacing of the units and complete the yearlong curriculum addressing all of the Next Generation State Standards. The analysis of the data found that having clear priorities in the district and having a team of players that is willing to put in the time to adjust the curriculum to meet the needs of the learners is key to making the integrated curriculum successful for the learners in the district.

Research Question #2

The second research question was, how are sustainability themes integrated into the curriculum? As the district worked to embed sustainability into the integrated curriculum, they decided to breakdown the sustainability themes by grade bands. In addition to the curriculum, the facilities were analyzed to make improvements. Each of the schools now have outdoor classrooms and garden spaces that are used throughout the year. The buildings' infrastructure and grounds and the local community were taken into account when writing the curriculum. The lessons were aligned to the grounds in order provide the students with place-based learning opportunities.

The data analyzed shows that the district made intentional decisions to embed the sustainability themes that would build from year to year in the curriculum. This proved successful through the Application of Knowledge projects that the students completed according to the participants interviewed. Activities were embedded in the regular school curriculum and in school clubs that took place during the school day and before or after school.

Research Question #3

The implementation of the sustainability themed curriculum changed the school's teaching and learning culture. Several teachers shared positive feedback about the activities that had sustainability themes because of the engagement level of the students and the place-based learning opportunities that the students had. They involved working outside in school gardens, being out in the neighborhood, or involving the community. The students were highly engaged in collaborative activities. Due to the pandemic the outdoor activities allowed for the students to work closer together according to social distancing guidelines. The teachers expressed that learning opportunities can be more engaging for the students when they use the natural environment to reinforce the learning.

The participants shared that through the place-based learning and choice projects the students were highly engaged in the sustainability themed lessons. Through the service announcements the students advocated for causes they felt passionate about. Through the districtwide events the students showed leadership when planning and executing the sustainable themed events and community drives.

Conclusion

Through the participant interviews, focus group, document collection and analysis, many themes emerged that demonstrate the effects of embedding sustainability into the curriculum. Staff and students collaborate. Infrastructure, including the buildings and school grounds are improved and are used as learning spaces that become an integral part of the learning experience. Students become highly engaged in their learning and develop a passion for bettering their planet.

Sarah, an instructional lead summed it up by saying, “Sustainability is one of the highest levels of empathy. It is caring about other things, other people, everything beyond yourself, and understanding everyone else's point of view.” Sarah’s voice exuted her feelings about the importance of teaching sustainability. She continued to emphasize that “teaching about sustainability is teaching learners that you need to care.”

Through the districts integrated curriculum students are engaged in learning that is giving back to others, and bringing awareness to decision making that puts the future of planet at the forefront. The students learn to have empathy for others and for our planet. The curriculum provides transdiciplinary opportunities for the students as they go beyond the academic subjects considering the real world implications of their learning.

CHAPTER 5

Introduction

This case study was of primary school teachers and administrators in a suburban New York school district. The study examined how teachers and administrators of students in kindergarten through sixth grade perceive integrating sustainability into their classrooms and school. This study addressed three research questions. The first question inquired about the processes useful for embedding sustainability into an integrated curriculum. The second research question investigated how the sustainability themes were integrated into the curriculum. The third research question examined how the implementation of a sustainability themed curriculum changed the school's teaching and learning culture.

The data analyzed in this study consisted of interviews with administrators and teachers, a focus group, and a review of a variety of documents including the integrated curriculum of grades kindergarten through sixth grade, district professional development documents, teacher created materials, and district newsletters and documents, and social media posts. Through the analysis of the data collected, three key themes emerged. The first theme involved the planning and preparation of the integrated curriculum which revealed that it was developed through collaboration, is constantly being reflected on and modified, and was based on the changing standards. The second theme that emerged was where sustainability practices live in the district which included school facilities, embedded in instruction, and through community awareness activities. The third theme revealed the teachers' reflections of their experiences including the student engagement level of sustainability themed activities. This chapter will discuss the major findings,

from the analysis of data, to address each of the three research questions. It will additionally connect the findings to the existing literature reviewed in chapter two.

Interpretation of Results

Research Question #1

The first research question in this study investigated the processes that were useful to embed sustainability into the integrated curriculum. The analysis of the data found the school district to be very successful in the arduous task of creating an integrated curriculum that covered the Next Generation Standards along with the district's priorities, one of which being sustainability. The frustration with the inadequacy of external published curricula to meet the needs of the students the district serves was minimized. The teachers were investing their own expertise into the development of it because there was teacher buy in. By them taking on the ownership of the curriculum they seemed to be fully vested in it after the first year of implementation. The teachers felt supported and respected by the district and building leaders. The ongoing assessment and reflection of the units allowed the teachers to make adjustments to the curriculum that benefited the students. Using a living document allowed for collaborative work amongst all of the stakeholders which allowed everyone to share their reflections for future adjustments. This method proved to be very successful for the faculty to share their ideas and make curriculum changes during the summer curriculum writing sessions.

Research Question #2

The second research question was, how are sustainability themes integrated into the curriculum? Through interviews with teachers, administrators, and instructional

leaders, and through an examination of district documents, the researcher determined there were beneficial shifts in content and student engagement with the integration of sustainability. The breakdown of the Big Ideas of sustainability into grade bands proved to allow for sustainability concepts to be taught in meaningful ways that built on each other throughout the students' educational experience. The students were engaged in sustainability themed lessons that were integrated with English Language Arts, social studies, science, and mathematics lessons through real world experiences that took their students into the field. The students took ownership of their learning by making improvements to their school and their community. The teachers and administrators expressed their belief in the importance of teaching sustainability concepts to students at an early age. They wanted to bring awareness to the environmental issues and the inequalities that our world is facing. The initial concerns some teachers expressed around integrating sustainability for students at a young age could possibly have been because previously they had never been taught in a practical context. They were always very abstract or removed from their real-life experiences. Therefore, having the integrated curriculum afforded the students opportunities to be engaged in lessons that they could apply to their own experiences. This made it accessible to students in their earliest formal education.

Research Question #3

The final research question addresses how the implementation of sustainability themed curriculum changed the school's teaching and learning culture. There was a positive shift in attitudes toward teaching and learning during the development and implementation of the integrated curriculum. The reluctant feelings that some of the

teachers felt were overcome by a willingness once they began to see the benefit to the students. Some teachers were afforded the opportunity to reflect on and correct some of their own misconceptions about their students' ability to understand and engage with higher level learning concepts around sustainability. What they discovered was that when they thought their students would not understand subject matter that had always been taught as abstract concepts, they were able to engage with the topics in a way that they could relate to them by using their own community and life experiences through the hands-on and place-based activities. That could be an explanation of why some kindergarten teachers found that the students were much more capable than they believed they could be.

According to the teachers, the students expressed overwhelming excitement and engagement around the topics. They were presented in a practical manner that the students could relate to. The integrated curriculum afforded the students many additional opportunities to go deeper into their own areas of interest. The lack of time to address all of the standards when each subject was taught in isolation was alleviated through the implementation of the integrated nature of the curriculum. Prior to integrating the curriculum many social studies and science standards were not able to be addressed. The district's unique approach of creating their own integrated curriculum that addressed the Next Generation Learning Standards and the districts priorities proved to increase the leadership opportunities for the students by providing many choice activities related to sustainability. Overall, the participants perceived the students favorably while engaged in sustainability themed activities.

Relationship between Findings and Theoretical Framework

Prior research supports the findings in this study. Through embedding sustainability themes into the integrated curriculum, the Morris School District uses a transdisciplinary approach because it allows the students to think creatively and work collectively on projects (Nordén, 2018). The students are going beyond the traditional disciplines and transcend into the themes of sustainability through the districts integrated curriculum. The teachers are providing transdisciplinary learning experiences and incorporating sustainability which can cause the heart and mind to naturally question daily-life choices that promote cultural change (Clark and Button, 2010). The curriculum units go further than integrating content areas by going beyond them, applying the learning to real world problems we are facing around sustainability. Lyons Higgs and McMillan (2006) found through their study that the schools that modeled sustainable behaviors rather than students simply being told about sustainable practices were more likely to adopt those behaviors.

The integrated curriculum created end unit projects referred to as Applications of Knowledge that encouraged student leadership and advocacy. According to Quinn and Owen, (2016) this prepares students to be active informed citizens. The Applications of Knowledge allowed opportunities for student choice which is important to show understanding of new concepts (Ray, 2002). Additionally, the district's Applications of Knowledge supported the constructivist theory and the movement that emphasizes the student's active role in their learning (Terwel, 1999). The study done by Satchwell (2013), suggests that education is not always an effective way of motivating action. The study found that learning about your carbon footprint does not automatically transfer to

the change in behaviors necessary to make change. In the Morris School District, the students are applying their learning in actionable ways. Lyons Higgs and McMillan (2006) similarly found that students transferred the concepts they learned through tangible application. The curriculum that was developed by the Morris School District has students actively engaged in their learning and applying their learning in the field through and beyond the traditional disciplines.

Relationship between Findings and Prior Research

The findings of this study have many similarities to prior research. In this study, many of the teachers were participants in the creation of, or the summer modifications of the integrated curriculum. This allowed them to take on ownership of the units and to become action researchers. They engaged in this work during the professional learning communities to make improvements to the curriculum. Similarly, the study done by Penuel et al. (2014) found that the teacher that was a co-designer of the science unit had engaged more fully with it than the teacher that was not part of the redesign. It found that teachers being part of curriculum design was an effective way of promoting teacher learning. The Morris School District made it a priority to build in time to the weekly schedule that allowed teachers to transform from practitioners to analytical practitioner researchers that analyzed student data to make informed decisions about curriculum improvements. The use of the shared Google Drive and the regularly scheduled professional learning communities provided the time and ability for the teachers to reflect on their teaching and on the curriculum to make continuous improvements to it while keeping the integrity of it (Penuel et al., 2014). Similarly, the research study done by Vijaya Kumari (2014), found the importance of teachers using reflective practices to

enhance their professional knowledge and skills which results in transformative learning. Through the use of the professional learning communities the district uses this constructivist approach to reflect on the students' learning experiences to make adjustment to the curriculum.

The Morris School District's integrated curriculum was able to embed sustainability themes through the STEM curriculum along with other disciplines. They aligned the sustainability strands by grade band to make it more manageable for the district to address the Next Generation Standards and big ideas of sustainability in the limited amount of time in the school year. The district clearly defined the strands and standards that were being addressed in each unit. In the study done by Hopkinson and James (2004), education for sustainable development was more likely to succeed when they were clearly related to core scientific and technical competencies. The Morris School District prioritized the connection between science content and sustainability which according to the participants was beneficial for the students and made the learning experience authentic. The district's integrated curriculum allows the teachers to address all the standards and the additional district priorities. According to Drake and Burns, (2004) an integrated curriculum is the only way to cover all the standards in a limited amount of time. This district referred to the same issue. Prior to the integrated curriculum the participants stated they were not addressing all of the standards, especially the science and social studies standards. When the district implemented the new curriculum, it was confirmed by the participants that all of the standards were able to be addressed. The participants believed that by integrating the content across many disciplines the students gained deeper understanding of their learning.

This study found that the integration of sustainability themes created opportunities for the students to engage with the community through place-based learning and hands-on activities. Green and Somerville (2015), similarly found that interacting with the local community was an essential part of sustainability education. In their study, it included the school grounds, the larger community, and building community partnerships. These activities provided students with inquiry learning experiences similar to that which were observed in the Morris School district through the use of the school yard habitats, the quail project, and Operation Splash. The district included sustainable practices when planning for infrastructure improvements. This study found that the place-based learning opportunities that were embedded into the curriculum were highly engaging and provided authentic learning opportunities for the students. Similarly, in Green and Somerville (2015) study, they found that using the school grounds and local places in the community helped students feel responsible and create connection to their world. Students moved beyond the classroom and posed questions and inquired about solutions.

Limitations of this Study

As a result of the COVID-19 pandemic, the researcher was limited to conducting all interviews virtually. The researcher was not permitted to make in-person visits to collect documents. All of the documents analyzed were gathered through the district public website, through district social media, and through the participants. When a researcher is able to be in the field, they may observe activities or see documents that could lead to further analysis of the topic being studied. Without being at the schools, the researcher had to rely on the participants providing what they felt would further the

study. The researcher did request any pertinent materials, but the researcher may have gained more information if they were in the field.

Another limitation is that the participants were chosen through purposeful and deliberate sampling. They were not randomly sampled. The researcher first contacted the building administrators and STEM teachers. Due to the limited amount of time and in-person access to additional rapport building, participants were asked to suggest additional participants that may be willing to participate in the study. If there was additional time, or if the researcher could have been in the field, they could have spoken to additional teachers that could have provided more insight on the topic.

Participants were interviewed in their schools about their place of employment. Participants were fully aware of the confidentiality of their interviews, but some participants' responses may have been influenced due to wanting to highlight the positive aspects of their school and district. Some participants may have been reluctant to share negative feelings about their place of employment.

An additional limitation of this study is that the data collection took place over the course of three months of the 2020-2021 school year. The COVID-19 pandemic impacted traditional practices. Social distances impacted student collaboration opportunities. Participants were asked to respond to questions thinking about past and present teaching practices. The findings of this study may be limited to this one particular circumstance.

Due to the COVID-19 pandemic, the researcher was not able to interview students to get their firsthand perspective of the integrated curriculum and how they feel about

sustainability topics being integrated into it. Due to the inability of the researcher to be in the building, only the perspectives of the staff were analyzed.

Implications for Future Research

Future studies into teachers' perceptions towards integrating sustainability into the curriculum could be replicated in different school districts in different settings to produce a larger body of research on the topic. Schools in rural, urban, and suburban settings could be compared. School districts at different stages of implementation could be studied to compare methods of implementation. School districts could be compared in order to determine what subjects sustainability is integrated into. How the implementation is rolled out could be analyzed.

Future research could analyze how districts implement sustainability initiatives into the middle and high schools' curriculum. This could pose a greater challenge because middle school and high school curriculum tend to be more isolated silos. Within the typical elementary schooling experience in the United States, one teacher is the primary instructor for the students. The students spend the majority of the time during the school day in one classroom, so the teacher has the ability to integrate the subjects. In middle and high school, the subjects are more isolated as the students move from class to class, from teacher to teacher. Researchers may find that integrating sustainability may be more suited to only certain topics in isolated subject matters due to the nature of secondary level curriculum priorities and state standards. Studies could be done to compare the level of integration of sustainability topics in middle and high school across multiple subjects or within one subject area such as science.

An additional suggestion for future research is to get the perspectives of the students as they participate in sustainability themed activities. This would provide an additional layer for the research and would provide a firsthand account from the students themselves. Researchers could observe students working on sustainability themed activities and interview them to get their account. Students' perspectives would be different than teachers and administrators. Student voice could determine whether the students are interpreting the information that the teachers are providing the way that it is intended.

A final suggestion for future research is to use a mixed methods approach. Adding a quantitative survey that measures perceptions towards sustainability and the integrated curriculum could be used. A mixed methods study would be able to expand the sample of participants and allow for the research to see if the findings from the study are transferable. Additionally, a quantitative measure of students' performance could be used to compare schools with similar demographic makeup that integrate sustainability and schools that do not. This could be an indicator of if education for sustainability brings more rigorous instruction or transfers higher level thinking skills into other academic areas.

Implication for Future Practice

A problem of practice many districts face is not being able to address all of the learning standards over the course of the school year. A lack of time is one of the biggest complaints of most educators. The Morris School District proves that it is possible to cover all the Next Generation State Standards while also addressing additional district priorities. Implementation of an integrated curriculum is a way of alleviating the time

constraints. Other school districts can learn from this case study that although integrating sustainability themes and/or implementing an integrated curriculum may seem overwhelming at first, with the support of the instructional leaders and administration, there is great benefit to taking on the challenge.

The Morris School District recognized the importance of integrating sustainability themes into their curriculum to bring awareness to the climate crisis that our planet is facing. Human activity is the major cause of global warming. We need to take big steps to reverse the negative impact humans have caused. The students that are currently in our schools will feel the effects of the past generation's actions. Substantial changes to human behavior need to be taught in order to prevent further destruction of our planet.

It is crucial for students to begin learning about sustainable practices from the moment they enter the education system, if not before. It is easier to form sustainable habits from an early age than it is to change bad habits once they are formed. It is the responsibility of the school system to integrate the Big Ideas of Sustainability in order to help students become global citizens and environmental stewards. It is the responsibility of the school system to teach students how to make informed decisions that consider the long-term consequences of their actions.

Each school district is unique. One curriculum does not fit the needs of all learners. Like the Morris School District, each district needs to modify the curriculum whether it is creating the entire curriculum or modifying it to meet the needs of the learners in the district and the needs of the local community.

Districts that are interested in creating an integrated curriculum to fit the needs of their community should understand that it is an ongoing process. It takes a lot of

planning and a team with key players that have a clear vision of the needs of the district and are able to get others onboard. District leaders should start with a clear understanding of the district priorities and the Next Generation State Standards. Districts shouldn't do it alone. They should find outside professional development that is aligned to the district's priorities if they do not have experts within their staff. With determination, hard work, a clear vision, and continuous reflection a district can make it happen.

Conclusion

The findings in this study reveal that primary school teachers and administrators have positive perceptions towards incorporating sustainability into their integrated curriculum. Even though there was reluctance by some when the integrated curriculum was first introduced, once implemented staff had positive perceptions of it.

The creation of the district's integrated curriculum was a shared approach. Key players throughout the district with different titles worked together to develop the integrated curriculum that embedded sustainability into the learning at all grade levels.

The embedding of sustainability themes was not limited to the district's STEM program. Sustainability was included in the district's integrated curriculum from kindergarten through sixth grade in all subject areas. The district initiative of embedding sustainability topics throughout the curriculum established sustainability as a core value in the districts mission.

Educators at all levels perceived the students to be highly engaged when participating in sustainability themed activities. The district's integrated curriculum with embedded sustainability is a model for other districts to follow. It can be used as a guide

to further foster successful integration of sustainability to deepen student engagement and leadership.

EPILOGUE

The process of conducting this study gave me hope for the future of our planet but it also raised concerns. I found a school district that successfully embedded education for sustainability, but I discovered that it is a process that takes a lot of work, varied expertise, and trust from the stakeholders. I found many positives throughout this study, but I worry about the ability for other districts to replicate it. The district studied is small and has the freedom to make their own curriculum choices for their five schools (four of which were part of this study). I worry for larger school districts, such as the one that I work in, the New York City Department of Education. In New York City, there are many top-down decisions that are made that do not allow individual schools or districts to make their own curriculum choices.

The district studied entrusted their district instructional leaders, building leaders, and teachers to develop a curriculum that addressed the learning standards and the district priorities which was engaging for the students. On the contrary, most districts rely on commercial curriculum which are often siloed by content discipline. It would take a change to the way publishing companies create their curriculum to make them integrated or a restructuring of a district that prioritizes having curriculum writers on their staff that are entrusted with developing curriculum to meet the district's needs.

This research experience gave me insight into the potential benefits creating a personalized curriculum can create for students when they are implemented with clear priorities and purpose. I've learned that there are attainable solutions to time constraints that are faced by most educators when it comes to the demands of the learning standards. Conducting this study has inspired me to change the way my school addresses the science

and social studies standards. We are required to use a specific reading curriculum but we could take the first step to reorganize the science and social studies units to align them to the reading curriculum. In addition, our curriculum and facilities could be analyzed to add more integration of the big ideas of sustainability.

APPENDIX A IRB Approval

Date: 10-15-2023

IRB #: IRB-FY2021-369
Title: How Does Integrating Sustainability in Primary School Stem Programs Provide Students with Leadership Opportunities? Perspectives from Teachers.
Creation Date: 3-17-2021
End Date:
Status: Approved
Principal Investigator: Jeanne Marshall
Review Board: St John's University Institutional Review Board
Sponsor:

Study History

Submission Type	Review Type	Decision
Initial	Expedited	Approved

Key Study Contacts

Member Seokhee Cho	Role Co-Principal Investigator	Contact chos1@stjohns.edu
Member Jeanne Marshall	Role Principal Investigator	Contact jeanne.marshall03@my.stjohns.edu
Member Jeanne Marshall	Role Primary Contact	Contact jeanne.marshall03@my.stjohns.edu

APPENDIX B CONSENT TO PARTICIPATE IN A RESEARCH STUDY

(TEACHERS)

Consent to Participate in a Research Study
St. John's University

Title of Study: Integrating Sustainability Through STEM Programs Provides Leadership Opportunities for Students

Investigator: Jeanne Marshall

Name: Jeanne Marshall Dept: School of Education Phone: (516) 972-9933

Introduction

- You are being asked to participate in a research study that examines how incorporating sustainability into the curriculum provides leadership opportunities for students.
- You were selected as a possible participant because you are a teacher that may incorporate sustainability into your curriculum.
- We ask that you read this form and ask any questions that you may have before agreeing to be in the study.

Purpose of Study

- The purpose of the study is to understand how teachers incorporate sustainability into the curriculum and how it may provide leadership opportunities for students.
- Ultimately, this research may be part of a dissertation towards a Doctorate of Education in Administration and Supervision and published.

Description of the Study Procedures

- If you agree to be in this study, you may be asked to answer questions virtually through a virtual interview or a virtual focus group related to your experiences as teacher.
- If you agree to be in this study, you may be follow-up questions via email.

Risks/Discomforts of Being in this Study

- There are no reasonable foreseeable (or expected) risks. There may be unknown risks.

Benefits of Being in the Study

- While there are no expected direct benefits to participating, the findings of this study are intended to inform other educational institutions of the impact of incorporating sustainability into education and will assist the field of education.

Confidentiality

- The records of this study will be kept strictly confidential. Research records will be kept in a locked file, and all electronic information will be coded and secured

using a password protected file. We will not include any information in any report we may publish that would make it possible to identify you.

Payments

- You will not be paid for this study.

Right to Refuse or Withdraw

- The decision to participate in this study is entirely up to you. You may refuse to take part in the study at any time without affecting your relationship with the investigator of this study or St. John's University. Your decision will not result in any loss or benefits to which you are otherwise entitled. You have the right not to answer any single question, as well as to withdraw completely from the interview at any point during the process; additionally, you have the right to request that the interviewer not use any of your interview material.

Right to Ask Questions and Report Concerns

- You have the right to ask questions about this research study and to have those questions answered by me before, during or after the research.
- If you have any further questions about the study, at any time feel free to contact me, Jeanne Marshall at Jeanne.marshall03@stjohns.edu or by telephone at 516-972-9933.
- If you like, a summary of the results of the study will be sent to you.
- If you have any problems or concerns that occur as a result of your participation, you can report them to the Dr. Raymond DiGiuseppe, IRB Chair, at 718-990-1440. Alternatively, concerns can be reported by completing a Participant Complaint Form, which can be found on the IRB website at https://www.stjohns.edu/academics/provost/grants-and-sponsored-research/humanparticipants-irb-animal-use-research

Consent

Your signature below indicates that you have decided to volunteer as a research participant for this study, and that you have read and understood the information provided above. You will be given a signed and dated copy of this form to keep, along with any other printed materials deemed necessary by the study investigators.

Subject's Name (print): _____

Subject's Signature: _____ Date: _____

Investigator's Signature: _____ Date: _____

APPENDIX C CONSENT TO PARTICIPATE IN A RESEARCH STUDY

(ADMINISTRATORS)

Consent to Participate in a Research Study
St. John's University

Title of Study: Integrating Sustainability Through STEM Programs Provides Leadership Opportunities for Students

Investigator: Jeanne Marshall

Name: Jeanne Marshall Dept: School of Education Phone: (516) 972-9933

Introduction

- You are being asked to be in a research study of which examines how incorporating sustainability into the curriculum provides leadership opportunities for students.
- You were selected as a possible participant because you are an administrator that oversees teaching staff incorporating sustainability into the curriculum.
- We ask that you read this form and ask any questions that you may have before agreeing to be in the study.

Purpose of Study

- The purpose of the study is to understand how teachers incorporate sustainability into the curriculum and how it may provide leadership opportunities for students.
- Ultimately, this research may be part of a dissertation towards a Doctorate of Education in Administration and Supervision and published.

Description of the Study Procedures

- If you agree to be a participant in this study, you will be asked to answer questions via virtual interviews related to how your staff incorporates sustainability into the curriculum.
- You may be asked follow-up questions via email.

Risks/Discomforts of Being in this Study

- There are no reasonable foreseeable (or expected) risks. There may be unknown risks.

Benefits of Being in the Study

- While there are no expected direct benefits to participating, the findings of this study are intended to inform other educational institutions of the impact of incorporating sustainability into education and will assist the field of education.

Confidentiality

- The records of this study will be kept strictly confidential. Research records will be kept in a locked file, and all electronic information will be coded and secured

using a password protected file. We will not include any information in any report we may publish that would make it possible to identify you.

Payments

- You will not be paid for this study.

Right to Refuse or Withdraw

- The decision to participate in this study is entirely up to you. You may refuse to take part in the study at any time without affecting your relationship with the investigator of this study or St. John's University. Your decision will not result in any loss or benefits to which you are otherwise entitled. You have the right not to answer any single question, as well as to withdraw completely from the interview at any point during the process; additionally, you have the right to request that the interviewer not use any of your interview material.

Right to Ask Questions and Report Concerns

- You have the right to ask questions about this research study and to have those questions answered by me before, during or after the research.
- If you have any further questions about the study, at any time feel free to contact me, Jeanne Marshall at Jeanne.marshall03@stjohns.edu or by telephone at 516-972-9933.
- If you like, a summary of the results of the study will be sent to you.
- If you have any problems or concerns that occur as a result of your participation, you can report them to the Dr. Raymond DiGiuseppe, IRB Chair, at 718-990-1440. Alternatively, concerns can be reported by completing a Participant Complaint Form, which can be found on the IRB website at https://www.stjohns.edu/academics/provost/grants-and-sponsored-research/humanparticipants-irb-animal-use-research

Consent

Your signature below indicates that you have decided to volunteer as a research participant for this study, and that you have read and understood the information provided above. You will be given a signed and dated copy of this form to keep, along with any other printed materials deemed necessary by the study investigators.

Name (print): _____

Signature: _____ Date: _____

Investigator's Signature: _____ Date: _____

APPENDIX D VIRTUAL FOCUS GROUP PROTOCOL

Virtual Focus Group Protocol

Opening:
Thank you for taking the time to participate in this virtual focus group concerning incorporating sustainability into your curriculum. Your participation in this focus group supports my research study on how teachers perceive incorporating sustainability into their curriculum. Before we begin, is there anyone that does not want to participate in the focus group? If any of you decide at any point during the focus group that you no longer want to participate, please let me know.

Overview:
During the focus group, I am going to ask a few questions. After each question is asked, I will ask that each participant share their ideas in discussion with myself and the other group members. The entire focus group session will be captured through audio recording to allow for an accurate account of what takes place. The only people that will know what is said during this focus group are those of you that are participating during this group session. The discussion and transcripts from the focus group are completely confidential. When the results of the focus group are shared, none of your names will be included. Does anyone have any questions before we begin?

Focus Group Questions:

1. Tell me about your teaching experience (i.e., Number of years total/ in this school/ in this grade level, subject area, areas of specialization)
2. What position do you currently have?
3. Tell me about your district's integrated curriculum.
4. Do you/ your team have flexibility in your curriculum?
    a. Choice in topics/ lessons you want to teach
    b. Time allotment of lessons/ units
    c. Additions/ adjustments to the curriculum based on students' needs and/or topics of interest
5. What curriculum supports does your school/ district have in place for teachers?
6. Where do you see sustainability integrated into your curriculum?
7. Tell me about a unit that has sustainability integrated into it.
    a. What sustainability themes are involved?
    b. Who made the decision to integrate sustainability into it?
8. How do you perceive the student engagement when the learning tasks have a sustainability focus?
    a. What types of activities do the students participate in?
    b. Do you observe students taking leadership roles or advocating for causes related to sustainability?
9. How do you feel about teaching sustainability?
    a. Comfort level?
10. (Present document) Tell me about this ____?
    a. What unit was is a part of?

b. Tell me about what the students did.
c. Tell me about the student engagement during this activity.

11. What else should I know about sustainability in your school?

Closing:

Thank you for taking the time to share with me your thoughts about how sustainability is integrated into your curriculum. Your feedback will support my research study as well as serving as a model for other school districts. Thank you again.

APPENDIX E VIRTUAL INTERVIEW PROTOCOL (ADMINISTRATORS)

Virtual Interview Protocol

Opening:
Thank you for taking the time to participate in this virtual interview concerning incorporating sustainability into your school. Your interview supports my research study on how teachers perceive incorporating sustainability into their curriculum. The goal of this interview is to find out where you see sustainability initiatives being implemented in your school and curriculum. If at any time you decide you no longer want to participate, please let me know.

Overview:
During this interview I am going to ask a few questions. The entire virtual interview session will be audio recorded to allow for an accurate account of what takes place. The only people that will know what is said during this interview are you and me. The recordings and transcripts from the interview are completely confidential. When the results of the interview are shared, your name and your school's name will not be included. Do you have any questions before we begin?

Interview Questions:

1. How long have you been an administrator?
    a. What is your current position?
    b. What were your prior positions before becoming an administrator?
2. What are your views about your school's integrated curriculum?
    a. How/why did your school/ district begin using an integrated curriculum?
    b. Who was involved in planning the units?
3. How is your school's curriculum paced?
    a. Do teachers/ grades have flexibility within the units to integrate additional topics/ lessons?
    b. Where do teachers allow for student choice?
4. Where do you see sustainability themes being integrated into the curriculum?
    a. Who are your key players? (Is there a grade level, unit, or enrichment program that has sustainability themes?)
5. Who made the decision to incorporate sustainability?
6. What is your role in integrating sustainability into your building?
7. Can you tell me about a time you observed teachers and students engaged in sustainability themed activities?
    a. What was the activity/ lesson/ theme?
    b. Where did the activity take place?
    c. What was the students' engagement level?
8. What are your feelings about integrating sustainability into the curriculum?
    a. What are the benefits?
    b. What are the drawbacks?
9. Does your STEM/ Science programs or clubs integrate sustainability themes?

10. Is there anything else you would like to tell me about how sustainability is integrated at your school?

Closing: Thank you for taking the time to share with me your thoughts about how sustainability is integrated at your school. Your feedback will support my research study as well as serving as a model for other school districts. Thank you again.

APPENDIX F VIRTUAL INTERVIEW PROTOCOL (TEACHERS)

Virtual Interview Protocol

Opening:
Thank you for taking the time to participate in this virtual interview concerning incorporating sustainability into your program. Your interview supports my research study on how teachers perceive incorporating sustainability into their curriculum. The goal of this interview is to find out where you see sustainability initiatives being implemented in your school and curriculum. If at any time you decide you no longer want to participate, please let me know.

Overview:
During this interview I am going to ask a few questions. The entire virtual interview session will be audio recorded to allow for an accurate account of what takes place. The only people that will know what is said during this interview are you and me. The recordings and transcripts from the interview are completely confidential. When the results of the interview are shared, your name and your school's name will not be included. Do you have any questions before we begin?

Interview Questions:

1. Tell me about your teaching experience (i.e., Number of years total/ in this school/ in this grade level, subject area, areas of specialization)
2. What position do you currently have?
3. What are your views about your school's integrated curriculum?
    a. Have you been involved in the planning or decision making of your curriculum?
4. How is your school's curriculum paced?
    a. Do you have flexibility within your units to integrate additional topics/ lessons?
    b. Are you able to adjust the pacing of your curriculum based on student needs or student choice?
5. Where are sustainability themes being integrated into the curriculum?
    a. Who planned the integration of sustainability themes?
6. Can you tell me about a time that students were engaged in sustainability themed activities?
    a. What was the activity/ unit/ lesson/ theme?
    b. How long was the activity/ unit/ lesson?
    c. Where did the activities take place?
    d. What was the students' engagement level?
    e. Did the activity involve hands-on activities? Tell me about it.
    f. Were students collaborating during the activity?
    g. Did students take on leadership roles? Tell me about it.
7. Do you collaborate with other teachers at your school when planning or working on units that integrate sustainability themes?

8. How do you feel about teaching sustainability themed lessons?
    a. What is your comfort level?
    b. Benefits and/or drawbacks?
9. Is there anything else you would like to tell me about how sustainability is integrated at your school?

Closing: Thank you for taking the time to share with me your thoughts about how sustainability is integrated at your school. Your feedback will support my research study as well as serving as a model for other school districts. Thank you again.

APPENDIX G DOCUMENT ANALYSIS PROTOCOL

Document Analysis Protocol- *adapted from O'Leary (2014)*

1. Gather related texts
    a. District curriculum (Grades K-6: STEM, ELA, SS/Humanities)
        i. Curriculum maps, unit plans, lesson plans
    b. District newsletters
    c. Local newspaper articles
    d. Student work
2. Develop an organization and management system
    a. Upload documents to Atlas.it to store and manage all data
3. Make copies for annotation
4. Assess authenticity of documents
5. Explore Document agenda and biases
6. Explore background information
7. Ask questions about the documents
    a. Who produced it?
    b. Why?
    c. When?
    d. Type of data?
8. Explore Content
    a. Data Analysis through multiple rounds of coding
9. Present documents to participants to gain teachers perspective of content and use.

APPENDIX H RECRUITMENT LETTER

Dear Participant:

You are being invited to participate in my research study on how teachers and administrators perceive incorporating sustainability into their curriculum. This study will help to better inform educational leadership on implementing changes to curriculum by integrating sustainability.

I will be conducting this study as part of my doctoral dissertation for St. John's University, Department of Administration and Instructional Leadership.

Your participation in the research study will consist of a virtual interview and/ or a virtual focus group lasting from 30 – 60 minutes. Audio recordings will be made so that the data can be transcribed and analyzed. You may review the audio recordings and request that all or any portion of the recordings be destroyed, that includes your participation.

Pseudonyms will be used during transcription for all proper names in order to maintain confidentiality and anonymity. All consent forms will be kept separate from the transcription data to ensure that the names and identities of all participants will not be known or linked to any information provided.

Participation in this study is voluntary and at any point during the study you have the right to end your participation. All responses and feedback will be confidential and anonymous throughout the entire research study. This study has been approved by the Superintendent of Schools and the Institutional Review Board of St. John's University. If you have any questions or concerns, please email me at Jeanne.marshall03@my.stjohns.edu, or call 516-972-9933. You may contact my faculty advisor, Dr. Seokhee Cho at chos1@stjohns.edu. For questions about your rights as a research participant, you may contact the University's Human Subjects Review Board, St. John's University, 718-990-1440.

Thank you! I truly appreciate your time and participation in this study.

Respectfully,
Jeanne Marshall

APPENDIX I SUPERINTENDENT ACKNOWLEDGEMENT OF STUDY

[redacted] Superintendent of Schools
School District
[redacted]

Dear [redacted]:

I am currently a Doctoral student at St. John's University in Queens, New York. I am writing to request formal approval to conduct a research study on how teachers and administrators perceive incorporating sustainability into their curriculum. This study will help to better inform educational leadership and teachers on implementing changes to curriculum by integrating sustainability.

I am reaching out to request formal permission to conduct virtual focus groups and virtual individual interviews of teachers and administrators from [redacted] School and to collect documents such as curriculum maps during the 2020-2021 academic school year.

If you agree to have your school district participate in this study, please sign the superintendent consent form. I am also providing for your review, the consent forms for both administrators and teachers. Additionally, copies of the virtual focus group questions, virtual individual interview questions, and the document analysis protocol are attached if you would like to preview them.

During the collection of the qualitative data, teachers will be given a pseudonym in order to maintain confidentiality. The results of this research study will be shared with the Superintendent of Schools. Thank you for your time and consideration of this request.

If you would like to grant permission, please email the approval to Jeanne.marshall03@my.stjohns.edu. If you have any questions, please do not hesitate to contact me at 516-972-9933 or my faculty sponsor, Dr. Seokhee Cho, at chos1@stjohns.edu. For questions about rights of research participants, you may contact the University's Human Subjects Review Board, St. John's University, 718-990-1440.

Respectfully,
Jeanne Marshall

APPENDIX J SUPERINTENDENT APPROVAL

Superintendent Approval

Attn: St. Johns Institutional Review Board

I have reviewed Jeanne Marshall's research protocol, including any letters of consent, titled "Integrating Sustainability Through STEM Programs Provides Leadership Opportunities for Students." I understand what she is asking of the individuals and grant her permission to conduct her study in [redacted] School District. I have the authority to do so.

If I have any further questions about this research study, I understand that Jeanne Marshall can be reached at (516) 972-9933 or via e-mail at Jeanne.marshall03@my.stjohns.edu. I also understand that if I have any questions regarding this IRB approval or the rights of research participants, I can contact Raymond DiGiuseppe, Ph.D., Chair, St. John's Institutional Review Board, at (718) 990-1440 or via e-mail at digiuser@stjohns.edu.

Signature: _____ Date _____

[redacted].
Superintendent of Schools
[redacted]

APPENDIX K RESEARCH ETHICS TRAINING CERTIFICATE

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