Starting from Here: An Explortion of the Space for Sustainability Education in

Elementary Science and Social Studies

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ABSTRACT

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Starting from Here: An Exploration of the Space for Sustainability Education in

Elementary Science and Social Studies

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Sustainability education (SE) is a pathway for creating a more socially,

economically, and environmentally just and sustainable world. SE involves the

incorporation of sustainability concepts into curricula using innovate teaching methods

(i.e. place-based education, outdoor education, experiential education, nature-based

education). This thesis explores the space for SE in Grade 5 science and social studies

classrooms. Using the case study methodology, this study looked to practicing teachers

for insights on how SE could be integrated into the public education system. This study

investigated teachers' understanding of sustainability and practice of SE by analyzing

their perceptions of sustainability, examples of SE lessons, and their sources of

knowledge about sustainability. The results indicated that teachers' understanding of

sustainability is largely focused on environmental aspects and that teachers' practice of

SE also has an environmental focus. This study evaluated the feasibility of teaching SE in

the classroom by outlining the challenges and opportunities for SE presented by teachers.

While there are some factors that limit teachers' ability to teach SE (i.e. teachers' limited

knowledge about sustainability, lack of training in SE, and institutional demands), with

guidance and support from education institutions and community partnerships current and

future teachers can provide SE for their students.

DEDICATION

This thesis is dedicated to the people of Athens County for being committed, resilient, and visionary community members who are striving for a just, sustainable world.

ACKNOWLEDGMENTS

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CHAPTER 1: INTRODUCTION

This thesis explores the space for sustainability education (SE) in the public

education system. Specifically, this study investigates the potential presence of and

opportunity for SE in Athens County Grade 5 science and social studies courses through

a qualitative case study analysis of practice teachers and a review of literature pertaining

to sustainability, education, teacher education, and sustainability education.

Background

We are at a critical point in history, facing complex social, ecological, and

economic challenges unlike any other generation. The trajectory of the economically

driven, modern industrial society is fundamentally challenging our "planetary

boundaries" (Kosoy et al., 2012). Now, and throughout our future, we must learn how to

address the ever evolving issues of energy insecurity, food sovereignty, water scarcity

and pollution, environmental degradation, climate change, poverty, social justice, human

health and human wellbeing; we must learn how to live sustainably.

As a species, we are utterly disconnected from the effects we have on each other

and ecological systems. While this is especially true for the global elite, Globalization

and the corresponding adaptation of modern technology and mechanisms for daily life is

decreasing our awareness of how we are able to exist in the world and how our existence

and livelihoods affect social, ecological, and environmental systems (Mündel & Mündel,

2011). Everyday, we flip a switch, turn on the tap, fill up the gas, load up the shopping

cart, flush the toilet, and a plethora of other daily life activities without thinking. Nature

is a resource, humans are workers, and it is better for our conscience if we ignore the true social, economic, and environmental costs of living (Phillips, 2014).

Society needs a change of consciousness. Educating about the relationships between human and ecological systems and how they can exist in a way that is socially, economically, and environmentally supportive of these systems can reroute the trajectory of the human race and the planet (Smith, 1999; Redman, 2013a; Phillips, 2014). It is possible for us to meet our needs without disrupting human-ecological systems (DeBerg, 2011). Indeed, humans are capable of designing a society that promotes the thriving of human and ecological systems. A change of consciousness, an understanding of human-ecological systems, and a dedication to creative problems solving can change the world. Sustainability education is attempting to do just that.

<div align="center">Context</div>

> No generation ever faced a more daunting agenda. True. But none ever faced more exciting possibilities either. (David Orr, 2007)

In order to live more sustainably, "adults and children must learn how to interact differently with both the natural world and its human inhabitants" (Smith, 1999, p. 208-209). It is argued that sustainability education is especially necessary for children, starting as young as preschool, so that they can learn, from the start, how to think about the world through the framework of sustainability (Davis & Elliot, 2014). Scholars argue that we must challenge the "social demarcation between adulthood and childhood…[and the] legislation, regulations, social infrastructures, and metanarratives of children as developing, innocent, and protected" (Phillips, 2014, p. 195). Children are curious about the world, passionate about learning, and have demonstrated that they want to "be active

contributors in society" (Phillips, 2014, p. 196) and sustainability education is a way from them to nurture their desire for learning and using their knowledge in the real world. It is critical to educate people about sustainability throughout their education, starting with the K-12 education system. The public education system is "one of the most powerful tools for transferring dominant forms of knowledge and values through enculturation and colonization (Fielding, 2004)" and, therefore, the presence of sustainability education in schools is important for preparing sustainability literate citizens (Colucci-Gray, 2014, p. 643) Today's youth will need to know how to deal with the years of unsustainable choices made by their predecessors, how to understand the social, environmental, and economic implications of everyday life, and how to navigate towards a more sustainable future. Indeed, the "qualities, depth and extent of learning that takes place globally in the next ten to twenty years will determine which path is taken: either moving towards or further away from ecological sustainability" (Sterling, 2001, p. 12).

There is a growing movement to integrate sustainability education the public education system. While the public education system has been called out for being "unresponsive to the fast changing social and ecological environments in which we live, and more responsive to the desires and assumptions of the corporate sector" (Greenwood, 2010, p. 140-141), there are efforts taking place to a educational system that is "aimed at preparing children to shape and sustain an ecologically beneficent society" (Smith, 1999, p. 208). To investigate whether this type of transformative education is taking place, Tenam-Zemach (2010) proposes two critical questions: "1) Are we preparing current and future generations to think ecologically, environmentally, and for sustainability?, and 2)

Are these students learning the skills necessary to problem solve, work independently, and think holistically?" (p. 122). To investigate whether or not today's youth are learning about sustainability we can look to teachers and beyond them by examining the educational institution and the various factors (i.e. standards, pre-service teaching programs, professional development opportunities, resources) that influence what and how teachers are teaching.

This study aims to investigate the space for sustainability education in the public education system, specifically in the context of elementary education. This study looks to teachers, who are ultimately the messengers for sustainability educations, to investigate the factors that influence the presence or absence of sustainability education in the classroom. This research is guided by the following research questions:

Q1: What are teachers' perceptions of sustainability?

Q2: What challenges and opportunities facilitate teachers' practice with respect to sustainability education?

Q3: What, if at all, approaches do teachers use to teach sustainability education?

This thesis explores the space for sustainability in Athens County Grade 5 science and social studies courses.

Objectives and Location

This study investigates Grade 5 elementary teachers' knowledge, beliefs and implementation of sustainability education in order to determine the space for sustainability education in the Athens County School District elementary curricula. The information from this study can lead to avenues for further implementing sustainability

education in Athens County elementary schools. The findings of this study could also be used to address the issue of implementing sustainability education in other contexts. Information from this study could also inform how pre-service teacher programs and continuing education programs in the region can better equip teachers for teaching sustainability education.

The Athens County School District, located in southeastern Ohio consists of the following school districts: Alexander Local School District, Athens City School District, Federal Hocking Local School District, Nelsonville-York City School District, and the Trimble Local School District. Athens County, nested in the geographic and cultural region referred to as Appalachia, has been, and continues to be, the site of economic development through the extraction and distribution of natural resources (iron, timber, coal, natural gas). The county also has an agricultural history and currently a thriving local food system, the hallmark of which is the Athens County farmers market which provides opportunities for sustainable economic development (for over 100 vendors) and networking amongst sustainability-minded community members (Gerbasi, 2006). A number of local institutions and governing bodies spanning across energy (e.g. Third Sun Solar, Dovetail Solar, Upgrade Athens), environmental (e.g. Rural Action, Raccoon Creek Partnership), health (e.g. Community Food Initiatives, Live Healthy Appalachia), social (e.g. Appalachian Peace and Justice Network), political (e.g. Athens County Fracking Action Network, Democracy over Corporations), economic (e.g. Appalachian Center for Economics Network), waste (e.g. Appalachian Ohio Zero Waste Initiative, The Compost Exchange) and educational sectors (e.g. Rural Action, Live Healthy

Appalachia, Upgrade Athens) incorporate sustainability principles and practices. While many of these initiatives are concentrated in the City of Athens, some elements of sustainable development are present in the rest of the county.

Due to the general prevalence of sustainability in Athens County, at the onset of this study, I expected to find teachers to be generally knowledgeable about sustainability and for sustainability themes to be integrated into their curriculum. However, I suspected that the language used by the teachers might not necessarily be framed as "sustainability education." I suspected that teachers would be aware of pertinent sustainability issues at a local, regional, national, and global level and that these issues would percolate into the classroom.

From my previous involvement in education initiatives in Athens County, I knew that some teachers in the county were passionate about issues related to sustainability and interested in incorporating sustainability education into their curricula. Before the onset of this research, I had been involved in both formal (public school field trips) and informal (homeschooling co-operatives) education initiatives in the county. From 2012-2014, as part of my Graduate Assistantship at Ohio University, I planned and facilitated environmental and sustainability themed field trips for Athens County school groups. These field trips primarily took place at the Ohio University West State Street Research Site, a garden site I help maintain for educational use. Of the teachers who brought their students to the field trips I facilitated, two of them later became involved in this research study. Through these experiences, I learned that there is an interest in experiential, place-

based, environmental, and sustainability education and I was able to connect with teachers who are interested in this type of education for their students.

Overview

This chapter illustrated the complex problems of humanity and the planet, introduced sustainability education as a strategy for addressing these challenges, and presented the framework for this study. Chapter 2 defines the concepts of sustainability and sustainability education, examines the potential relationships between sustainability education and the education system and teacher education, and explores the factors that influence whether and how teachers teach sustainability education. Chapter 3 outlines the design of this qualitative study and the utilization of the case study methodology. Chapter 4 presents the themes that emerged through this research. Chapter 5 summarizes the research findings, presents the researchers reflections, discusses the implications of this research, and suggests avenues for further research.

CHAPTER 2: LITERATURE REVIEW

Sustainability Education is the convergence of the concept of sustainability with the practice of education. Using pertinent literature from sustainability, education, and sustainability education research, this chapter provides the foundational background for this study. The first part of this chapter defines sustainability and illustrates the models and frameworks for sustainability and sustainable development. The second part of this chapter presents sustainability in the context of education and compares sustainability education with education for sustainable development and environmental education. The third part of this chapter describes how sustainability education is applied to education, by exploring some of the challenges and opportunities within the current structure of the education system and academic disciplines. The fourth part of this chapter addresses the roles of teacher education programs for preparing teachers to teach sustainability education. This chapter concludes with an investigation of the factors that influence whether and how teachers teach sustainability education by examining their value, understanding, and teaching of sustainability education.

Defining Sustainability

Sustainability is a difficult concept to define. The root of the term sustainability is "to sustain" and the definitions of sustainability vary as to what is to be sustained, how it is to be sustained, and why it is to be sustained. Sustainability is used as a general term in everyday contexts to describe a plethora of phenomena. Thus, the meaning of sustainability is dependent on the context in which the term is used (Yanarella & Bartilow, 2000, p. 371). Academic and community entities are attempting to use sustainability in a specific and definitive manner as a way to discuss issues that may need

addressed, and present a pathway for the present and future. These conversations revolve around the relations between human and ecological systems and the complex interactions between social, economic, and environmental systems. In this context, there is much debate on the term sustainability, its inferences, and its implications due to the fact that "sustainability is a broad and far-reaching, even all-encompassing concept that fosters a variety of views and perspectives" (McFarlane & Ogazon, 2011, p.85). Specifically, the debate hovers around the way social, economic, and environmental systems interact and the weight of importance given to these aspects. These ideological viewpoints influence how sustainability is defined and how models for sustainability are presented.

Models for sustainability

The debate over the way sustainability is defined and can be examined by looking at the different models of sustainability. The classic models of sustainability include the three ring model, the three pillar model, and the concentric circle model (see Figure 1).
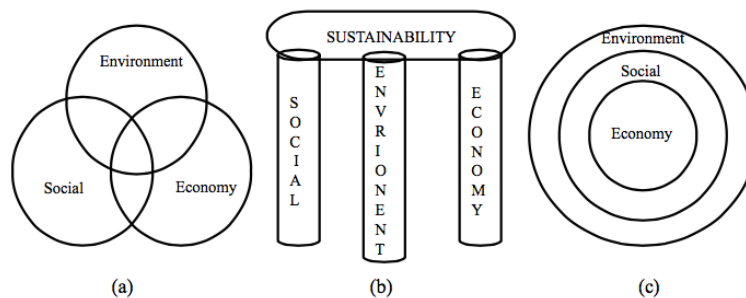
Figure 1. Models for sustainability. Adapted from Giddings, Hopwood, & Obren, 2002 and Opp & Saunders, 2013.

This figure illustrates how different models represent the concept of sustainability. Figure 1(a) portrays the three ring model of sustainability where the environment, social, and economy aspects of sustainability are portrayed as circles of equal sizes. Sustainability in this model is the place in the center where all three rings overlap. Figure 1(b) depicts the three pillar model where the aspects of sustainability are equally weighted pillars holding up the larger concept of sustainability. Figure 1(c) presents the concentric circle model of sustainability where the economy aspect is encompassed by (dependent on) the social aspect and both of these aspects are encompassed by (dependent on) the environment. Sustainability is the image in its entirety.

The three ring model of sustainability, as represented in Figure 1 (a), is a Venn diagram made from three circles: social, economic, and environmental. In this diagram, the circles are equal in size and distribution. Sustainability is indicated as being the space where the social, economic, and environmental circles overlap. One of the largest critiques of this model is that it "distracts from or underplays the fundamental connections between the economy, society, and the environment….[and] if they are seen as separate, as the model implies, different perspectives can, and often do, give a greater priority to one or the other…[which] leads to tradeoffs" (Giddings, Hopwood, & Obren, 2002, p. 189). The foundations of this argument are that if the economic, social, and environmental systems are viewed as separate entities, this implies that sustainability is "compartmentalised and disregards the interconnectedness within and among the three aspects" (Lozano, 2008, p. 1842). The concerns for the three ring model of sustainability are also present in the three pillar model of sustainability.

The three pillar model of sustainability, as represented in Figure 1 (b), is "made up of three interrelated and equally important pillars: environment, economics, and social justice or equity" (Opp & Saunders, 2012, p. 679). A different version of this model is that of a three-legged stool. The idea that if one pillar or leg is removed from the system the building or chair crumbles or falls. This model of sustainability is similar to the three ring model of sustainability in that it depicts social, economic, and environmental aspects of sustainability as distinct pillars. Instead of overlapping to obtain sustainability, the pillars are 'holding up' sustainability. Overall, the same concerns attributed to the three ring model of sustainability are applied to the three pillar model of sustainability in that is presents economic, social, and environmental aspects as separate entities (Opp & Saunders, 2012; Gibson, 2006). Economic, social, and environmental aspects are presented as separate entities, but embedded within each other in the concentric circles model.

The concentric circle model of sustainability, as represented in Figure 1 (c), presents economy, society, and the environment in three nested circles. This model presents sustainability in a way where the economic systems are dependent on social and environmental systems and social systems are dependent on environmental systems. In other words, changes in one system impact the other systems and all systems are dependent on the environment. The concentric circle model of sustainability is described as "a more accurate presentation of the relationship between society, economy, and the environment" because it demonstrates that, inherently, the systems are not equal (Giddings et al, 2002, p. 191). Some scholars have argued that the concentric circle model is insufficient because "the delimiting of the three aspects by the use of circles

does not really reflect the complex inter-connectedness that actually exists among them"
(Lozano, 2008, p. 1842). While this model is preferred by advocates of the New
Ecological Paradigm (Sterling, 2009), it is still contested as being an adequate
representation of sustainability. There have been some initiatives to develop new, more
complex models defining sustainability (Giddings et al, 2002; Lozano, 2008; Dimitrov,
N.d.), however, models can only express the concept of sustainability to a certain extent
because it is difficult to capture the essence of sustainability in a digestible model. The
concentric circle model could be improved by incorporating additional details for how
these interactions play out in reality in different scenarios but, in its current form, it is
able to concisely represent the interconnectedness and interdependencies of economic,
social, and environmental systems. The following section explores some of the
frameworks for sustainability.

Frameworks for sustainability

One of the most predominant frameworks for sustainability is the Brundtland
Commission's framework for sustainable development. Sustainable development, which
emerged out of the 1992 United Nations Conference on Environment and Development--
referred to as the "Earth Summit"-- defined sustainable development as "that which
meets the needs of the present without compromising the ability of future generations to
meet their own needs" (Odgers, 2009, p. 306). The framework for sustainable
development is a result of an international recognition that the global crises (namely the
environment crises, the development crises, and the energy crises) are one large crisis
that requires an international initiative (World Commission on Environment and

Development, 1987). Despite the international popularity and adoption of this framework, sustainable development is a concept that is largely contested.

Sustainable development is criticized as being more focused on economic development than on the social and environmental aspects of sustainability (Giddings et al, 2002, p. 187). Economically driven models for sustainability are problematic in that they ignore the interconnectedness and dependencies of economic, social, and environmental systems and the complications that arise when social and environmental compromises are made in the name of economic development. The sustainable development framework is more aligned with the three ring and three pillar models of sustainability in that it portrays economic, social, and environmental systems as independent and, explicitly and implicitly, describes trade-offs in one or more aspect (i.e. environmental and social) can be made for the betterment of other aspects (i.e. economic). Indeed, the environmental and social aspects of sustainability are sacrificed for economic gains due to the hegemonic structure of the capitalist economic system (Nyberg & Wright, 2012, p. 418). Since sustainability is dependent on the "equitable distribution of environmental amenities or goods" and the "consideration of social needs and equal economic opportunity"(Opp & Saunders, 2012, p. 682) sustainable development is often referred to as an oxymoron (Livingston, 1994; Sachs, 1999). Given the international popularity of this model, the compromising of social and environmental systems for the pursuit of economic gains at a global scale is challenging and undermines the principles of sustainability. Due to the conflicts embedded in the sustainable development framework, recommendations have been made for adapting the framework so that it is not driven by economic drivers.

A revitalized framework for sustainable development, that acknowledges the interconnectedness and limitations of economic, social and environmental systems was developed by Griggs, Stafford-Smith, Gaffney, Rockström, Öhman, Shyamsundar, and Noble (2013). The definition of sustainable development, in this framework, was adjusted to "development that meets the needs of the present while safeguarding earth's life-support system, on which the welfare of current and future generations depends" (Griggs et al., 2013, p. 306). This recommended definition specifically speaks to the underlying importance of social and environmental issues. Griggs et al. (2013) elaborate on this framework by presenting the following sustainable development goals:

1) *Goal 1*: Thriving lives and livelihoods. End poverty and improve well-being through access to education, employment and information, between health and housing, and reduced inequality while moving towards sustainable consumption and production;

2) *Goal 2*: Sustainable food security. End hunger and achieve long-term food security including better nutrition—through sustainable systems of production, distribution, and consumption;

3) *Goal 3*: Sustainable water security. Achieve universal access to clean water and basic sanitation, and ensure efficient allocation through integrated water-resource management;

4) *Goal 4*: Universal clean energy. Improve universal, affordable access to clean energy that minimizes local pollution and health impacts and mitigates global warming;

5) *Goal 5***:** Healthy and productive ecosystems. Sustain biodiversity and

ecosystem services through better management, valuation, measurement,

conversation and restoration; and

6) *Goal 6***:** Governance for sustainable societies. Transform governance and

institutions at all levels to address the other five sustainable development goals.

(p. 307)

The goals outlined by Griggs et al. underscore that social, economic, and environmental

systems cannot be addressed in isolation from one another and that sustainability is a

fundamentally interconnected concept. Thus, it is more aligned with the concentric circle

model of sustainability. The framework presented by Griggs et al. is also rich in detail

and articulates clear, grounded goals that are far reaching. The sustainable development

goals are recognized as a prominent and effective framework for sustainability and serve

as a model for the 2015 Millennium Development Goals (Gerst, Raskin, & Rockström,

2013; Steffen & Stafford-Smith, 2013). Currently, there are seventeen sustainable

development goals that have been proposed. Negotiations will be taking place in July

2015 to finalize the outcome of these goals (United Nations Department of Economic and

Social Affairs).

Overall, sustainability can be seen as a framework for creating a more socially,

economically, and environmentally just and sustainable world. One of the major avenues

towards sustainability is sustainability education.

Framing Sustainability Education

Sustainability education and education for sustainable development

At its core, sustainability education (SE) is the process of educating people about sustainability so that, individually and collectively, they can work towards creating a more environmentally, socially, and economically sustainable world. Sustainability education "implies [a] whole paradigm change, one which asserts both humanistic and ecological values" (Sterling, 2009, p. 14). Scholars argue that the current education model is unable to provide the transformative education necessary for this paradigm shift (Orr, 2004; Apple, 2005; Sterling 2009). Sustainability education "focuses on critically examining information about the myriad of problems that exist, and exploring possible sustainability solutions to these problems" (Burns, 2011, p. 203). Thus, sustainability education can provide the tools necessary for redirecting the trajectory of the human race and the ecological system it inhabits.

Sustainability education emerged as an alternative to Education for Sustainable Development (ESD) and its "counterparts" (i.e. Education for Sustainability [EfS], Education for a Sustainable Future [ESF], Education for the Environment and Sustainability [EES]). Education for Sustainable Development surfaced as a result of the 1992 United Nations Conference on Environment and Development. This "Earth Summit" led to the adoption of Agenda 21, an action plan for achieving sustainable development worldwide. Education was one of the major strategies for sustainable development, motivating world leaders to address how sustainable development could be implemented into education curricula (Lundholm & Plummer, 2010; Breiting & Wickenberg, 2010). In 1994, the United States responded to Agenda 21 by creating an

action plan entitled *Education for Sustainability: An Agenda for Action.* This plan

outlined how education for sustainable development could be implemented into education

curriculum. The President's Council on Sustainable Development (PCSD) is the most

prominent international project on ESD and serves as the basis for ESD (Feinstein, 2009,

p. 2). PCSD, however, uses the principles of sustainable development and ESD but uses

the term education for sustainability. The PCSD defines education for sustainability as:

> [A] lifelong learning process that leads to an informed and involved citizenry
>
> having the creative problem-solving skills, scientific and social literacy, and
>
> commitment to engage in responsible individual and cooperative actions. These
>
> actions will help ensure a prosperous future. (President's Council on Sustainable
>
> Development, 1996)

In 2005, the United Nations Educational, Scientific, and Cultural Organization

(UNESCO) set the following objectives for ESD:

> 1) Incorporating Sustainable Development into pedagogy and curricula from pre-
>
> school to university;
>
> 2) Steering lifelong education on the acquisition of knowledge, skills and values
>
> needed by future citizens to improve and sustain the quality of life in a sustainable
>
> world;
>
> 3) Raising awareness of the concept of Sustainable Development, to develop
>
> responsible citizenship locally, nationally and internationally; and
>
> 4) Providing continuing education to teacher trainers, pre-service and in-service
>
> teachers to enable Sustainable Development to become a reality.
>
> (Boon, 2011, p. 38)

These objectives are far reaching in nature and provide a basic structure for which the sustainable development goals can be implemented into the education system. The overall goal of ESD is to educate people in a way that leads to the fulfillment of the sustainable development goals (recommended by the Brundtland Commission). As described earlier in this chapter, scholars have contested the Brundtland Commission's sustainable development goals and the concept of sustainable development because of its anthropocentric and economic development driven framework (Selby, 2009). There is similar concern about the promotion of sustainable development through ESD.

In addition to the criticisms of ESD, given its foundation in sustainable development, scholars oppose the concept of ESD and its offshoots because of fundamental conflictions with education *for* something. Selby (2009) argues that "there is something anti-educational about an education that is *for* something" because it suggests "closure according to goals and outcomes before the learning process has even begun" (p. 206). Education *for* something (i.e. sustainable development) suggests that the solution is already present and that what is necessary is merely the process of teaching the solution (i.e. the Brundtland Commission's sustainable development goals) (Sterling, 2009, p. 116). McClaren (1993) presents the following analogy: "If sustainable development is converted into an ideology rather than remaining an idea in the process of development, a working set of principles, then it will be intellectually fossilized, an insect idea trapped in conceptual amber" (p. 18). If a "fossilized" version of sustainable development is used for ESD, the ability for society to transform is limited. It is argued that ESD is promoting a static and moderate framework that hinders a sustainability revolution. The "apparent progress" of ESD, which was "bolstered by the UN Decade of ESD" overshadows the

"uncomfortable tension between accommodation and radical transformation approaches" (Sterling, 2009, p. 115). Sterling (2009) summarizes the need to move away from the *for* sustainable development and *for* sustainability frameworks:

> Sustainable education is ultimately about...integrating and balancing process (what education is) with purpose (what education is for), so that they are mutually informing and enhancing. It builds on the best of existing thought and practice in the liberal humanist tradition, but in many respects goes beyond this. It acknowledges the long held belief in liberal circles that education is about nurturing and realizing inherent potential, *but also* is acutely aware that we need to educate for sustainability, community and peace in a turbulent and rapidly changing world. (p. 26)

While SE has its roots in ESD, it is advocated that it is time to move away from the constrictions of the ESD framework to the more adaptive and holistic framework of SE. The following section reflects on how SE and ESD originated from Environmental Education (EE).

Sustainability education, education for sustainable development, and environmental education

Sustainability Education (SE) and Education for Sustainable Development (ESD) emerged as a response to, and a recommended replacement of Environmental Education. The field of Environmental Education (EE) is traced to the late 1960s and early 1970s as a method for increasing awareness on environmental issues. The prevalence of the practice of EE was brought to international attention at the 1968 UNESCO Biosphere Conference in Paris, France. Palmer (1998) explains how EE was then defined as:

The process of recognizing values and clarifying concepts in order to develop

skills and attitudes necessary to understand and appreciate the inter-relatedness

among man, his culture, and his biophysical surroundings. Environmental

education also entails practice in decision-making and self-formulation of a code

of behavior about issues concerning environmental quality. (p. 5)

The language used to articulate EE reflects the promotion of what is arguably referred to

as a biocentrism. Biocentrism is defined as a philosophical orientation that is

environmental-centered (Watson, 1983). Out of this philosophy is a drive to educate

"people to be aware of, concerned and actively involved in working towards the

resolution of environmental problems and preventing new ones" with a focus on

addressing "human relationship with nature" (Kopina, 2012, p. 702). The focus of

environmental education is intrinsically linked to environmental problems. A rise in

awareness of the interconnectedness between environmental issues and economic and

social issues and the internationally recognized goals of sustainable development led to

the emergence of Education for Sustainable Development, and later, sustainability

education.

There is debate in the literature about the relationship between ESD and EE.

Eilam and Trop (2011) outline the various perspectives on the relationships between EE

and ESD (see Figure 2).
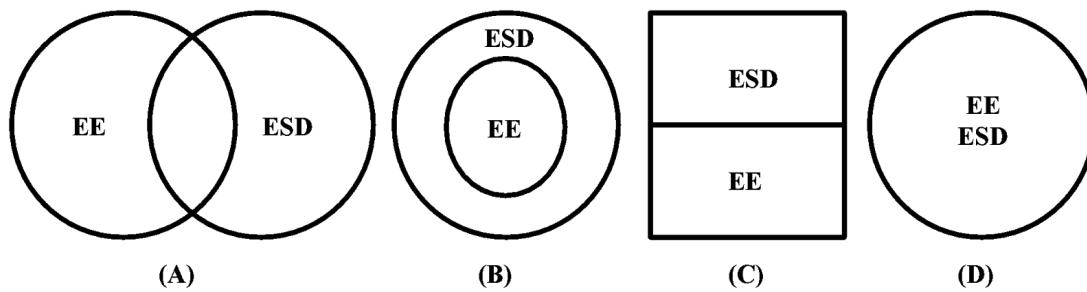
Figure 2. Relationships between EE and ESD. Adapted from Eilam & Trop 2011.

ESD is largely seen as a concept that emerged out of EE as a way of more holistically addressing environmental issues by also focusing on social and economic aspects. This conceptualization of ESD, as represented in Figure 2 (c) and Figure 2 (b), is widely accepted in the literature (McKeown & Hopkins, 2009; Eilam & Trop, 2011). The difference between Figure 2 (b) and Figure 2 (c) is that Figure 2 (b) stressed the importance of maintaining the subfield of EE and Figure 2 (c) projects that ESD can adequately include the elements of EE and, therefore, ESD in and of itself is sufficient. Other scholars see ESD and EE as being either separate entities, with overlapping elements, (Breiting & Wickenberg, 2010; Fien & Tilbury, 2002) or entirely the same concept, as shown in Figure 2 (d) (Orr, 1992). Some scholars have attempted to throw out ESD altogether. Sauvé and Berryman (2009) recommend reverting back to EE in order to "move beyond sustainable development" (p. 232). As described in the previous section, other scholars advocate for Sustainability Education.

It is important to keep the framing SE, ESD, and EE in mind throughout the following sections as we explore the contexts for sustainability education in practice. This thesis uses the framework of sustainability education. However, in the following

sections, the terminology used when describing individual studies will be consistent with the literature from which the research was sourced.

<div align="center">Applying Sustainability Education</div>

<div align="center">*SE and the structure of the education system*</div>

The current structure of the US education system poses both challenges and opportunities for sustainability education. Some advocates of sustainability education call for a systemic restructuring of the public education system in the United States entirely (Sterling, 2009; Greenwood, 2010). However, it must be recognized that the public education system is well established and that there are consistently initiatives emerging, by sustainability education advocates and others in attempts to improve the system so that it can better educate today's youth.

Academic pressures and the rising demands of state and national standardized testing are major concerns about the public education system. There is an increased "pressure on specific academic disciplines (i.e. reading, mathematics, and science) and a push away from cross-disciplinary education", leaving less time and financial support for other disciplines, especially those in the humanities (Feinstein, 2009, p. 3). The preparation for and administration of standardized tests consumes a large part of the education system and is constraining for administrators, teachers and students (Redman, 2013). Sustainability education is not an established focus in the predominating academic disciplines nor is it included in standardized testing. This makes the advocacy for and the implementation of sustainability education fundamentally challenging.

Despite the institutional challenges, there are some avenues for sustainability education within the current structure of the public education system. The US education

system is decentralized. Within a decentralized education system "decisions about education are often made at the state or local level" (Feinstein, 2009, p. 1). There is a fair amount of autonomy between states and schools as to how they meet the demands of the state and national education system. Even within schools, teachers "have substantial autonomy in choosing what to teach" (Feinstein, 2009, p. 3). Some states are taking initiatives to integrate sustainability education into their curriculum. In the US, Washington, Oregon, Vermont, California, and Connecticut have implemented sustainability into their state curriculum and Minnesota and New Jersey are working towards the integration of SE (Vosburg-Bluem, 2012). Thus, a fundamental restructuring of the entire public education system is not entirely necessary for implementing sustainability education. There is space in the current education system for small and slow solutions that aim towards the integration of sustainability education into the education system. The following section surveys the space for sustainability education in the academic disciplines.

SE and academic disciplines

Given the nature of sustainability, sustainability education is intended to be an interdisciplinary concept (Colucci-Gray, 2014). Sustainability education has been recommended across disciplines but is largely concentrated in the disciplines of science and social studies (Edwards, 2005; Nasir, Yaacob, & Hashim, 2012; Feinstein, 2009; Sterling, 2009). Some advocates of sustainability education have called for a tighter relationship between science and social studies (Metz, McMillan, Maxwell, & Tetrault, 2010) claiming that "combining the efforts of science and social studies educators may be the best way to provide students with realistic and powerful preparation for the

sustainability challenges that their generation will face" (Feinstein & Kirchgasler, 2015, p. 141). Feinstein and Kirchgasler (2015) are not advocating for a merging of science and social studies per se, but collaboration between the fields. They recommend in that science and social studies teachers working together on the "planning, design, and implementation of lessons that address circuital sustainability topics" so that students are able to understand the importance of cross-disciplinary education and action as well as develop a deep and broad understanding of sustainability (p. 140). The following section presents the science and social studies disciplines and their relationship with sustainability education.

SE and science

While science is the discipline most often associated with sustainability education, some scholars argue that inclusion of SE in science is fundamentally problematic. The arguments against SE in science claim that "a scientific discipline-based approach to a socio-scientific or socio-environmental controversy would be both a betrayal of the goals of science education research and the scientific disciplines themselves" (Albe, 2013, p. 189). Opponents to SE in science claim that science must be an "unbiased" discipline that refrains from involvement in "political" issues where "different groups have different interests" (Albe, 2013, p. 189). This is problematic for proponents of SE in science, who advocate for strong interdisciplinary ties between science and other subjects like social studies (Nasir et al, 2012; Metz et al., 2010). The recommended exclusion of SE from science is challenging for SE advocates because school-based science education has been recognized as reaching "a larger and broader audience than any other science education platform" that is largely responsible for

providing the opportunity for students "to learn about the role of science in public life" (Feinstein & Kirchgasler, 2015, p. 137). Therefore, omitting SE from science utterly defeats the underlying efforts of SE which are to educate students about the interconnectedness of environmental, social, and economic systems so that they can be part of an informed citizenry.

There are initiatives in science education that are advocating the incorporation of the social aspects of science into science education curriculum. One of the predominant curricular initiatives is the socio-scientific issues framework (Gray & Bryce, 2006; Colucci-Gray, 2014). Socio-scientific issues (SSI) have been found to "provide the necessary contexts for students to connect personal, scientific, and social dimensions [of science] to make informed decisions…and are widely regarded as contributing to scientific literacy (Zeidler and Keefer, 2003)" (Lee & Grace, 2010, p. 156). Rather than detracting from the political and social implications of science, the SSI framework recognizes the inherent value, moral, and ethical issues of sciences, addresses the power of science in the production of knowledge, and encourages critical engagement with the social, political, and cultural aspects of science (Colucci-Gray, 2014).

Amidst the conflicts of science and SE, sustainability is included in both the Ohio New Learning Standards: Science and the Next Generation Science Standards (both of which are the guiding science standards for the state of Ohio). In the Ohio New Learning Standards: Science, sustainability is included in middle and high school science curriculum as a topic "Global Environmental Problems and Issues" topic in high school Environmental Science; however, there is no formal standard for sustainability. In the

Next Generation Science Standards (NGSS), there is a specific sustainability standard; however, the effectiveness of the inclusion of this standard is debated.

When evaluating the inclusion of sustainability in the 2013 Next Generation Science Standards, it is important to examine the larger context within which this initiative is stemming from. The NGSS is focused on preparing "young Americans...to succeed in a global economy" (*The Need for New Science Standards*, n.d.). To meet this goal, the NGSS present four targets that the standards aim to address:

1) Reduction of the United States' competitive economic edge;

2) Lagging achievement of US students;

3) Essential preparation for all careers in the modern workforce; and

4) Scientific technological literacy for an educated society. (*The Need for New Science Standards*, n.d.)

The targets of the NGSS are grounded in the perpetuation of economic development, which fundamentally influences the ways in which sustainability can be presented in the standards and is, therefore, potentially problematic.

A "human sustainability" standard was added to middle and high school science education. The new standard contains the following educational components:

1) Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity; and

2) Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios. (Next Generation Science Standards Lead States, 2013, p. 287)

Advocates of SE claim that, while the presence of sustainability in the standards is significant, the way that sustainability is presented in the standards is problematic or even counterintuitive to the goals of SE. Tenam-Zemach (2010) interpreted sustainability in the Next Generation Science Standards to stem from a strong "anthropocentric perspective" and be closer aligned with the weighted goals of sustainable development than sustainability education (p. 134). Feinstein & Kirchgasler (2015) echo these remarks and added that the NGSS "vision of sustainability...lacks the strong ethical components and the awareness of social complexity that can be found in other discussions about sustainability" (p. 135). Feinstein and Kirchgasler (2015) acknowledge that this 'vision of sustainability' is consistent with the current frameworks for the natural sciences. Given that school-based science education is responsible for education most of the general public about science-based issues, it is recommended that a new set of science standards, that more accurately presents the interconnectedness of environmental, social, and economic systems is created (Tenam-Zemach, 2010; Feinstein & Kirchgasler, 2015). The current framework of sustainability in the NGSS would arguably "lead students to think of sustainability in the reduced terms of ecological modernization. If this happens, they may ultimately be less prepared to see the ethical and political dimensions of emerging sustainability challenges" (Feinstein & Kirchgasler, 2015, p. 135). Therefore, misconceptions about the role of science and sustainability could have lasting, detrimental effects on society and its ability to address issues of sustainability.

Feinstein and Kirchgasler (2015) present the potential effects of the NGSS use of sustainability by describing how a potential lesson, based on the "human sustainability" standard could play out in the classroom:

Students in our hypothetical classroom would learn about the relationship

between human behavior and climate change in terms of the carbon cycle and the

burning of fossil fuels, but they would probably not be asked to think about who

has historically burned and continues to burn the majority of the fuels and who,

both across and within societies, is harmed most by the practice...Burning fossil

fuels would probably be framed as something that humans (in general) do and that

humans may, in turn, be affected by. Students and teachers would discuss the

potential impacts of climate change in relatively precise geophysical terms (such

as degrees of warming and meters of sea level rise) but very vague social terms. If

students were asked to consider possible solutions, they would be encouraged to

propose new technologies, changes in the balance of existing technologies, and

regulatory regimes that aimed to change carbon consumption. Other sorts of

change--including normative changes, social movements, or policy changes that

indirectly influence climate--would receive little or no attention" (p. 136).

This hypothetical example illustrates the implications of a narrowed version of

sustainability and alludes to the effect this style of education would have on the way that

future leaders of the world view, evaluate, and address sustainability issues.

SE and social studies

While sustainability is less often associated with the social studies discipline,

sustainability education is extremely applicable to social studies (Nasir et al., 2012). As a

discipline, social studies involves a "commitment to democratic values, and requires that

citizens have the ability to use their knowledge about their community, nation, and world;

to apply inquiry processes; and to employ skills of data collection and analysis,

collaboration, decision-making and problem-solving" (NCSS, 2010, p.3). Houser (2005)

describes social studies "as a means of preparing citizens who could respond to late

nineteenth- and early twentieth-century social tensions related to population growth,

demographic diversity, increased immigration, growing urbanization, industrialization,

and a widening gap between the rich and the poor (Barth, 1984; Hertzberg, 1981)" (p.

127). Thus, the frameworks for social studies education could be elaborated to include

the interconnectedness between social, economic, and environmental issues. The

following recommendations for SE and SS have been adapted from Vosburg-Bluem

(2012)"

> 1) *SE concepts already exist within the SS curriculum and can be used in their*
>
> *current form* (using what is already there, such as local/global citizenship);
>
> 2) *SE can be placed into spaces within the current social studies curriculum*
>
> (moving familiar concepts from within SS and other subjects and using them in
>
> multiple places in the current SS curriculum, such as environmental/social and
>
> local/global impacts);
>
> 3) *SS concepts can be reframed (repurposed)* to align more closely with SE goals
>
> (such as moving from predicting the future based on the past, towards using the
>
> past and present to envision a new future); and
>
> 4) *SS goals can be redesigned and reframed* to address the value of living in a
>
> sustainable world and the complex multidimensional relational thinking required
>
> to understand and act upon these values. (p. 325)

These recommendations point to the opportunities for SE in social studies. However,

there is little research on the feasibility of SE in social studies education. Of the limited

research on SE in primary and secondary school standards in the U.S., "virtually none of

it informs the specific domain of social studies" (Vosburg-Bluem, 2012, p. 14).

Sustainability is included in Ohio's New Learning Standards: Social Studies;

however, research on the way sustainability is included and the implications of this

inclusion are limited. Ohio's New Learning Standards: Social Studies added the topic

"Sustainability" and three corresponding content statements to the Modern World History

course syllabus for high school social studies classes. The topic Sustainability is

described in the following excerpt:

> An increasingly global society is faced with the interdependency of ecological,
>
> social, and economic systems. The functioning of these systems determines the
>
> sustainability of natural and human communities at local, regional, national and
>
> global levels. (Ohio Department of Education, 2010, p. 39)

This description of sustainability is relatively consistent with SE. However, the phrasing

of the description is slightly anthropocentric. The following content statements are

included in the topic of sustainability:

> 1) *Content statement 11:* Decisions about human activities made by individuals
>
> and societies have implications for both current and future generations, including
>
> intended and unintended consequences;
>
> 2) *Content statement 12:* Sustainability issues are interpreted and treated
>
> differently by people viewing them from various political, economic and cultural
>
> perspectives; and
>
> 3) *Content statement 13:* International associations and nongovernmental
>
> organizations offer means of collaboration to address sustainability issues on

local, national and international levels. (Ohio Department of Education, 2010, p.

39)

These content statements are important concepts to portray within the context of Modern

World History. They could be expanding to include more reference the environment. The

term "sustainability" is also used in the Modern World History topic Globalization, in

reference to "the world's resources" (Ohio's New Learning Standards, 2010, p. 35), and

the World Geography topic Environment and Society, in reference to the "costs and

benefits of using renewable, non-renewable, and flow resources" (Ohio Department of

Education, 2010, p. 40). Thus, Ohio's New Learning Standards: Social Studies include

sustainability in the standards but the effects of such usage have not been explored.

<center>SE and Teacher Education</center>

It is argued that in order for sustainability education to be present in the public

school system, sustainability education must be present in teacher education programs

(Greenwood, 2010; Boon, 2011; Evans, Whitehouse, & Hickey, 2012; Nolet, 2009;

Tilbury & Cooke, 2005). An international recommendation for EfS was emphasized by

the UNESCO Reorienting Teacher Education towards Sustainability Initiative. This

initiative deemed teacher education "a vital strategy for the incorporation of EfS in

school curricula" (Wilson, 2012, p. 44). In order to teach SE, teachers need "to feel

knowledgeable about the topics they are teaching and not feeling sufficiently

knowledgeable can make them hesitant about teaching sustainability topics" (Redman,

2013b, p. 13). Pre-service teacher education programs are largely responsible for

informing teachers' content knowledge, pedagogy, and practice. Evans et al. (2012)

present the argument that the inclusion of "environmental/sustainability education" will

lead teachers to "graduate with the capacity to embed environmental/sustainability education into their day-to-day work and, hence, enable widespread implementation (or mainstreaming) in schools" (p. 1). If teachers learn how to teach SE they can provide this education for their students.

There are different recommendations for how sustainability education should be incorporated into teacher education programs. However, the research on this topic is limited (Feinstein, 2009, p. 28). In the literature available, some claim that elements of sustainability education are already present in the existing teacher education curriculum which could be adjusted to more directly address SE. In a study on pre-service education programs in Australia, Boon (2011) found that "concepts related to sustainability are often subsumed under larger disciplinary areas and might include environmental science topics within a particular science discipline or matters of justice and equity in relation to studies of society and the environment" (p. 38-39). In accordance with this perspective, sustainability education in teacher education, in the form of "adding sustainability content to a course or a program," is more beneficial compared to the absence of any direct inclusion of sustainability education in pre-service education programs (Greenwood, 2010, p. 145). The presence of sustainability education concepts in the curriculum is noteworthy, but in order to provide students a clear understanding of sustainability it is argued that the disciplines themselves need to be directly linked to sustainability. Thus, there is a recommendation for the restructuring of teacher education programs so that SE is the main framework and all content and pedagogy stem from the lens of SE. Nolet (2009) called for this style of systematic inclusion of sustainability education in pre-service education programs:

English teachers must see sustainability as integral to the teaching of English;

mathematics teachers must learn to view sustainability as part and parcel of

mathematics teaching; and elementary education teacher must come to see

sustainability education as part of the work of teaching young learners. (p. 432)

In this perspective, sustainability education is proposed to be a major part of teachers'

identity and pedagogy. In order to attain this level of integration, Evans et al. (2012)

recommended that teacher education programs provide "critical and sustained exposure

to different EfS-related ideologies and worldviews through formal, embedded and

connected structures over the length of the degree (rather than through discrete subjects

or individual lecturers)" (p. 9). Greenwood (2010) points out that while an ideal is to

fundamentally integrate sustainability education into the pre-service education system,

"making any intervention to frame teacher education in the context of our current

local/global dilemmas is vital, and [that] these interventions, no matter how small, can

build over time toward deeper changes in course and program content and policy" (p.

146). It is important to note that there are currently a limited number of examples of

teacher education programs directly incorporate SE into their programs.

Despite the international call for SE in pre-service teacher education programs, at

the turn of the century the presence of SE in pre-service teacher programs is limited

internationally and relatively absent in the United States (Fien & Maclean, 2000;

Redman, 2013). There are a few examples of sustainability education in state and

national teacher education programs. A grassroots initiative led to the incorporation of SE

in teacher education programs in the state of Washington (Greenwood, 2010, p. 149-150).

In 2007, the state of Washington's Professional Educator Standards Board incorporated a

standard in their pre-service teacher education programs that called for teachers to be

"able to prepare K–12 students to be responsible citizens for an environmentally-

sustainable, globally interconnected, and diverse society…[and] to consider student

learning in the context of social, political, environmental, and economic systems"

(Wheeler, 2013, p. 113). In addition to including a standard for sustainability in pre-

service teacher education programs, the state of Washington also "developed and

eventually passed a new specialty teaching endorsement in Environmental and

Sustainability Education" (Greenwood, 2010, p. 149-150). Some other noteworthy

examples of sustainability education in teacher education programs include Arizona

University's Ponderosa Project, Emory University's Piedoment Project (Nolet, 2009,

p.435), and the National Curriculum in the UK (Boon, 2011, p. 39). There is still a need

for research on the effectiveness of these programs in terms of how they inform and

shape teachers' understanding and practice of sustainability education. The following

section explores existing research on in-service and pre-service teachers value,

understanding, and practice of sustainability education.

<p align="center">Teachers and SE</p>

In the context of the classroom, teachers are responsible for the teaching of

sustainability education. However, there are a number of factors that influence whether or

not teachers are teaching SE. Bertschy, Künzli, and Lehmann (2013) elaborate on the role

of teachers in SE by stating that "it is the task of the teacher to foster the students'

aptitude" for the:

> 1) Analysis of the regulative idea of sustainable development and its
>
> concretization;

2) Thinking about the meaning of sustainable development for oneself, for one's

own and the global society;

3) Development and evaluation of visions and alternative life designs and their

implementation; and

4) Negotiation and justification of decisions that are relevant for sustainability.

(p. 5074)

These responsibilities require that teachers understand sustainability, value its

importance, and develop techniques for integrating sustainability into their courses in

order to discuss its meaning, value, and implications. This section explores research on

teachers' value, understanding, and practice of sustainability education.

Value

The values and beliefs of teachers play an integral role in informing what and how

they teach (Evans et al., 2012; Sikes, 1992; Stevenson, 2007). Of the few studies that

explored teachers' value of sustainability education (McCormack & O'Flaherty, 2010),

"little is known about…teachers' thinking on the topic" (Evans et al., 2012, p. 2). When

researching teachers' value of ESD, Feinstein (2009) found that teachers "are concerned

about environmental problems and hold positive attitudes toward pro-environmental

behaviors and policies" but that they did not specifically attribute value to sustainability

issues (p. 38). Other studies found that teachers attributed value to sustainability issues.

Sustainability education is fundamentally value-laden, and at its heart, there are values

about "respect for others, those of present and future generations, for differences and

diversity, for the environment, and for the resources of the planet we inhabit" (Nasir et

al., 2012, p. 386). As described earlier in this chapter, there are different approaches and,

therefore, different values associated with sustainability, with some values (i.e. economic, social, or environmental) holding more value than others. In a study by Qablan, Southerland, and Saka (2011), the value-laden nature of sustainability kept teachers from teaching it in the classroom. This study found that while higher education teachers value sustainability education, they were actively abstaining from teaching sustainability education in the classroom because of a "fear of indoctrination" (Qablan et al., 2011, p. 14). This reasoning may be due, to some extent, to the fact that some teachers are teaching "pedagogical practices of transmitting discrete, disciplinary-derived, factual information and unproblematic 'truths'" (Stevenson, 1987, p. 140). A different study found that "teachers agreed that educating students for sustainability was inevitably value-laden, but in general [they] felt comfortable with this notion" (Taylor. Nathan, & Coll, 2011 p. 302). Thus, while there is agreement that sustainability education is embedded with values, there is disagreement as to whether teachers should be teaching these values.

Some studies on teachers' values of sustainability education explored the possible links between values, knowledge, and teaching. Spiropoulou, Antonakaki, Kontaxaki, and Bouras (2007), as quoted in Boon (2001), found that teachers' value of EfS was not linked to their knowledge (Boon, 2011, p. 40). While some studies speculated that teachers that value sustainability would take initiatives to learn about the subject in order to be better suited to teach it, this speculation was not supported by the literature (Boon, 2011, p. 46). The following section elaborates on teachers' understanding of sustainability and sustainability education.

Understanding

In order to teach sustainability education to their students, teachers themselves need to understand the concepts and key contemporary issues of sustainability and SE (Kennelly & Taylor, 2007, p. 3). There are different frameworks that classify an understanding of sustainability education. Nolet (2009) uses a framework for sustainability literacy:

> Sustainability literacy is construed generally here as the ability and disposition to engage in thinking, problem solving, decision making, and actions associated with achieving sustainability...it entails more than simply knowing things about the environment, economics, or equity and justice issues, but rather involves a willingness and ability to engage intellectually and personally with the tensions that are created by the interconnectedness of these systems. (p. 421)

Nolet's definition of sustainability literacy combines innovative teaching methods and a sense of purpose with the understanding of the interrelatedness of environmental, economic, and social issues. Bertschy et al. (2013) presented a framework for ESD competence components the recommend teachers have the following abilities:

> 1) Ability to choose possible teaching topics and to evaluate their aptitude for ESD regarding their economic, ecological, social and cultural design as well as their relevance for sustainability (pedagogical content knowledge);
>
> 2) Ability to make economic, ecological, social and cultural perspectives graspable and accessible to the students within a chosen topic and by means of questions as well as formulations of problems and tasks (pedagogical content knowledge);

3) Ability to recognize conflicts of goals and interests of agents in a field relevant

to ESD, and the knowledge and ability to constructively cope with them (content

knowledge);

4) Ability to appropriately confront learners with conflicts of goals and interests,

and the ability to enable and guide their attempts at constructive coping with them

(pedagogical content knowledge);

5) Knowledge of participative processes and process steps (content knowledge);

and

6) Ability to develop and provide efficient learning opportunities concerning the

qualification for participation (pedagogical content knowledge). (p. 5076)

Both the sustainability literacy framework and the ESD competence model including

pedagogical and content recommendations for how teachers can transfer their

understanding of SE into their practice of SE in the classroom.

The results of research on pre-service and in-service teachers' understanding of

sustainability and sustainability education varies. Some studies found that pre-service

teachers exhibited a limited understanding of sustainability (Feinstein, 2009) that was

either focused on either "social issues" (Feinstein & Kirchgasler, 2015), "ecological

systems/environmental issues" (Evans et al., 2012, p. 8) or "economic

growth/environmental awareness" (Nasir et al., 2012, p. 395). A study on university

teachers in Australia found that teachers' understanding of EfS varied and was limited in

scope and that, overall, "their perception was that EfS was limited to environmental

sustainability" (Wilson, 2012, p. 49). Evans et al. (2012) found that teachers associated

EfS with the following characteristics:

1) Education that is continuous (long term);

2) Education about ecological systems and environmental issues;

3) Education that is active, hands on, local and relevant; and

4) Education for the future. (p. 5)

The characteristics voiced by these teachers are limiting in that they focus on the environmental aspects of sustainability. Only one study, on pre-service primary and secondary teachers, indicated that some pre-service teachers recognized that EfS "incorporated a greater social dimension than environmental education…[and that] all teachers saw a need to consider issues outside the natural environment when addressing sustainability" (Taylor et al., 2011, p. 301). Overall, compared with the sustainability literacy framework developed by Nolet (2009) and the ESD competence framework developed by Bertschy et al. (2013), the teachers and pre-service teachers in these studies do not have a detailed understanding of sustainability or sustainability education. The following section explores existing literature on the factors that influence whether or not teachers are teaching SE.

Teaching

An exemplary model for teaching sustainability education is the Burns Model of Sustainable Pedagogy (Burns, 2011). The Burns model aims to be a guide for sustainability educators to effectively and innovatively teach sustainability education through the following dimensions:

1) *Content*: Increase learners' systemic understanding of complex sustainability issues;

2) *Perspectives*: Provide learners with opportunities to think critically about dominant paradigms, practices and power relationships and consider complex ecological and social issues from diverse perspectives;

3) *Process*: Enhance learners' civic responsibility and intentions to work toward sustainability through active participation and experience;

4) *Context*: Increase learners' understanding of and connection with the geographical place and the community in which they live; and

5) *Design*: Utilize an ecological course design process that weaves the other four dimensions together to create transformative learning experiences. (Burns, 2013, p. 167)

The Burns model is an extensive resource for teaching sustainability education that builds off of a number of well recognized, innovative, and effective pedagogies including place-based education (Smith & Sobel, 2010), experiential education (Qualters, 2010), nature-based education (Louv, 2005), and outdoor education (Sandell & Öhman, 2010). This model can be used to assess whether and how teachers are teaching sustainability education.

Another valuable model for addressing sustainability education is the futures thinking framework developed by Jones, Buntting, Hipkins, McKim, Conner, and Saunders (2012). The components of the futures thinking framework includes "understanding the current situation, analyzing relevant trends, identifying drivers, exploring possible and probable futures, and selecting preferable futures—each explored at a personal, local, national, and global level" (Jones et al., 2012, p. 708). This framework can be applied to different topics in science and social studies education. It

provides a simple, digestible guide for teachers to use to encourage discussion of SSI and sustainability in the classroom.

Of the limited studies on teachers and sustainability education, most of the research suggests that teachers address aspects of SE but that they do not associate their teaching with SE. A study of university lecturers in Australia found that "the principles of EfS and almost all of the content concepts were including in the teaching of existing units" although these teachings were "discrete, and not coordinated" or connected explicitly to SE (Wilson, 2012, p. 48). In this study, teachers did conceptualize their teaching as SE because "their perception was that EfS was limited to environmental sustainability" (Wilson, 2012, p. 49). Taylor et al. (2011) found that teachers were "intuitively incorporating [EfS] into [their] practice...despite not having heard of EfS" (p. 303-304). Similarly, Vosburg-Bluem (2012) found that social studies teachers "used many of the terms and principles associated with SE [but] without the purposeful intent of teaching for sustainability" (p. 359). Vosburg-Bluem elaborate on this point by saying "they were 'doing it' and they essentially were not aware 'it' had a name or an established framework within the context of education and definitely not within the social science/studies framework through which they were teaching" (p. 267). Teaching aspects of SE is arguably insufficient due to the fact that SE "involves approaches to teaching and learning that integrate and expose the complex interplay between the ecological, social, economic and political spheres of sustainability" (Evans et al., 2012, p. 8). Thus, teaching pieces of SE in various contexts, or indirectly teaching the concept, does not fully address the concepts of sustainability or provide SE for students.

There are a number of factors that compromise teachers' ability to teach SE in the classroom. As discussed above, the fundamental structure of the public education system, including "the pressures of an overcrowded curriculum, prioritization of literacy and numeracy over other subject areas…[and] tight disciplinary boundaries", confine teachers ability to teach sustainability education (Boon, 2011, p. 39). Teachers express concerns about meeting the needs of the standards for their academic discipline and saw sustainability education as a "time consuming and superfluous" add-on (Metz et al., 2010, p. 163). Additionally, teachers ability to teach SE is challenged by their limited understanding of sustainability and the lack of support by administrators, the standards, and curriculum developers (Stevenson, 2007; Redman, 2013b). Studies have acknowledged these constraints and have recognized that teachers do not necessarily need to be SE experts; they can have outside assistance from communities, universities, non-profit organizations, and for-profit organizations, "politicians, policymakers, and the public at large" (Stevenson, 2007, p. 283). It is argued that these "networks of assistance and support…can build collective expertise and commitment to learning about the creation of sustainable communities and societies" (Stevenson, 2007, p. 283). Support from outside entities has proved to be promising for teachers' ability to transmit sustainability education.

<div align="center">School-Community Partnerships and SE</div>

Many cases of teachers teaching sustainability education have occurred when teachers are motivated to teach SE and either seek out or are provided supportive resources to facilitate SE (Nolet, 2009, Feinstein, 2009; Boon, 2011; Evans et al., 2012; Nasir et al., 2012). In their study of sustainability education in Australia, Somerville and

Green (2012) found that the "rare exemplars of integrated sustainability education relied on partnerships, volunteer support and the dedication of particular visionary teachers to contribute over and above their normal teaching work" (p. 74). Partnerships with universities, NGOs, non-profit organizations, and community groups can assist "already over-committed teachers" by helping them "integrate sustainability into their subjects and standards" with curricula materials and educational opportunities (Redman, 2013b, p. 19). Some example outcomes of school-community partnerships include citizen scientist/activism programs (Bencze, Sperling, & Carter, 2012) and service-learning projects (Ponder, Vander Veldt, & Lewis-Ferrell, 2011). Partnerships have also been found to enhance the educational resources available for teachers to teach SE, including the installation and maintenance of school gardens (Williams, 2008) and the "greening" of schools with recycling, composting, and local food programs (Stone, 2007) as well as energy efficient transportation systems and renewable energy systems (Higgs & McMillian, 2006). Efforts have been made to develop curriculum guides for teachers so that they can utilize programs like the ones mentioned above and also incorporate stand-alone sustainability education lessons in their traditional classrooms (Redman, 2013b). There are a number of resources available on sustainability and sustainability education (i.e. Facing the Future, ESD Toolkit, Center for Ecoliteracy, Resources for Rethinking), however, these resources are not always catered to specific state curriculum standards and thus, teachers may have to adapt them to meet their needs, which takes additional time and energy.

While resources are helpful to teachers who are really interested and dedicated to teaching sustainability education (Evans et al., 2012), they may be overwhelming for

others depending on their commitment to teaching sustainability education and their

interest in the sustainability education content. Redman (2013b) provides

recommendations for how teachers can be assisted with SE curricula development and

implementation. The issues described above can be navigated if, in the absence of or in

addition to incorporation of sustainability education in pre-service teacher education

programs, school-community partnerships can facilitate SE in the following ways:

> NGOs can implement sustainability workshops (i.e. continuing education courses)
>
> that focus on linking standards to sustainability [and] outreach programmes
>
> (whether a part of universities, NGOs or businesses) can focus on developing
>
> curricula that link sustainability to core standards while also collaborating with
>
> teachers to adapt the curricula to their local context. (p. 12)

Additionally, Redman advises that community partnerships "link sustainability to diverse

domains of knowledge in areas that teachers are interested in" when developing curriculum

material and that they "structure workshops around the teachers' specific interests" (Redman,

2013b, p. 13). It is argued that this approach is more effective than teaching sustainability in

a broad context because it ensures teachers interests and builds off of their existing content

knowledge. When teachers are given appropriate curriculum resources, they have been

found to be able to teach sustainability education (Taylor et al. 2011, p. 304).

<div align="center">Summary</div>

Sustainability is a multi-dimensional concept that, when framed in the context of

sustainability education, can be used to address the complex issues society faces today.

Sustainability education is transformative by nature, setting lofty goals for the hearts and

minds of today's youth. Sustainability is up against a dominant social paradigm that

fundamentally disregards the principles of sustainability and an educational system that is not conducive to systemic change. Teachers, the proposed messengers of sustainability education, are yet to be learning about sustainability, internalizing its values, and teaching sustainability education to their students. Despite these odds, sustainability education is proving to be critical for our society and our planet. Scholars are recognizing the importance of sustainability education and are developing pathways for implementing sustainability education into the education system. The implementation of sustainability education will require a simultaneous, continued effort from committed community members, passionate teachers, forward-thinking universities, progressive policy-makers and academic scholars alike.

CHAPTER 3: METHODOLOGY

Introduction

This descriptive case study focuses on the issue of sustainability education. As illustrated in Chapter 2, sustainability education is introduced as an avenue for a more socially, economically, and environmentally just and sustainable future. Specifically, the public school system is presented as a promising channel for sustainability education due to the population size and demographics of individuals immersed in the public education system. In an effort to see whether or not sustainability education is present in the public education system and explore the space for further integration, this case study investigates teachers perceptions and practice of SE and the factors that influence their ability to teach SE. The focus of this study is articulated through the following research questions:

Q1: What are teachers' perceptions of sustainability?

Q2: What challenges and opportunities facilitate teachers' practice with respect to sustainability education?

Q3: What, if at all, approaches do teachers use to teach sustainability education?

The case study methodology is used to address the research questions presented above.

This chapter describes the defining factors, goals, uses, and types of case study methodology and research. Next, this chapter outlines how case study methodology is used for this research by outlining the research design, data collection, and data analysis process.

Research Design

Creswell (2007) defined a case study as an "exploration of a 'bounded system' or a case (or multiple cases) over time through detailed, in-depth data collection involving multiple sources of information rich in context" (p. 61). The case is a 'bounded system' in that it is a "specific, complex, functioning thing" intrinsically defined by the space, time, and circumstances in which the particular phenomenon exists (Stake, 1995, p. 2). A case could be "a person such as a student, a teacher, a principal; a program; a group such as a class, a school, a community; a specific policy, and so on" (Merriam, 1998, p. 27).

The goal of case study research is to "understand how the actors, the people, [programs, or policies] being studied, see things" (Stake, 1995, p. 12). Thus the focus is on portraying a rich understanding of the specifics of a phenomenon as opposed to presenting generalizations about a phenomenon or between phenomena. For instance, "the relationships among schools, the reasons for innovative teaching, or the policies of school reform are less commonly considered a case…[because] these topics are generalities rather than specifics" (Stake, 1995, p. 2).

The case study methodology is used in primarily in education and applied social science research (Merriam, 1998, p. 26). Merriam (1998) describes how "case study research in education is conducted so that specific issues and problems of practice can be identified and explained" (p. 34). The theoretical framework, data collection process, and data analysis processes for case study research in education are informed by social science disciplines such as sociology, anthropology, psychology, and history (Merriam, 1998, p. 34). The overarching intention of the research and the supporting theoretical framework determines which type of case study will be utilized.

Merriam (1998) identifies three main types of case studies in education research: descriptive, interpretive, and evaluative (p. 38). Descriptive case studies, as defined by Lijphart (1971), are "entirely descriptive and move in a theoretical cavum; they are neither guided by established or hypothesized generalizations nor motivated by a desire to formulate a general hypothesis" (p. 691). The intention of descriptive case studies is to provide information not currently prevalent in academic research that could then be used as foundational research for future studies that aim to generate theory (Merriam, 1998, p. 38). Interpretive case studies are detailed like descriptive case studies but they ultimately aim to "develop conceptual categories or to illustrate, support, or challenge theoretical assumptions held prior to the data gathering" (Merriam, 1998, p. 38). Evaluative case studies are both descriptive and interpretive. What distinguishes evaluative case studies is that they exert "judgment" by providing a detailed interpretation and evaluation of the theoretical framework of the case study (Merriam, 1998, p. 39). In summary, case studies are descriptive by nature and can involve interpretive and evaluative characteristics depending on the disciplinary foundation and the objective of the research.

Design of this Case Study

Research design

As demonstrated through the research questions presented in the beginning of this chapter, teachers' perceptions and practices are used to provide insight into the larger issue of sustainability education. Specifically, this case study focuses on the perceptions and practices of Grade 5 science and social studies teachers in Athens County. In accordance with Stake (1995) I decided to choose a case that would be "most likely to enhance our understanding than to pick the one most typical" (p. 134). By focusing on a

particular group of teachers (i.e. teachers that teach science or social studies for Grade 5) I was able to gain insight as to how teachers in a particular segment of the teaching population relate to sustainability education. This information is valuable for developing general insights into teachers' perceptions and practice of sustainability and sustainability education.

Site selection

The specific population of teachers chosen for this study was determined based on the following factors:

1) The researcher's proximity to Athens County;

2) The researcher's invested interest in and prior knowledge about sustainability education in Athens County;

3) The researcher's existing relationships with Grade 5 teachers;

4) The cognitive abilities of Grade 5 students; and

5) The content of Grade 5 science and social studies standards.

Teachers in Athens County were chosen for this case study because Athens County is where I have been living since 2010. Over the past five years of living in Athens County I have become immersed in various sustainability education initiatives through my work with non-profit organizations, the Athens City School District, Ohio University, Athens homeschooling cooperatives, and various groups and organizations in the Athens and Ohio University community.

In relation to this study, I have been involved in the development of sustainability education initiatives in the context of elementary education (i.e. public and private education programs) and higher education (i.e. pre-service teacher education programs,

sustainability education policy). Some of my work involved planning and facilitating standards-based, sustainability education programs for Athens City Grade 5 science classes and placed-based, sustainability education programs for pre-service teachers. Through these experiences, I developed relationships with teachers and education focused organizations and learned that there is an interest in sustainability education, specifically garden-based sustainability education in Athens County.

I decided to focus on Grade 5 teachers because of my existing relationship with teachers in this grade, my experience with students in this age group, and my familiarity with the standards for this grade. Children are thought to have developed the critical thinking skills necessary to explore and understand the complex issues inherent in sustainability education (Jones et al., 2012; Davis & Elliot, 2014). The science and social studies disciplines were chosen because these disciplines are most often with sustainability education given their focus on the environment and society, respectively. The culmination of these factors led to the formation of this case study research.

Research participants

After receiving permission from Athens County elementary principles and IRB approval, I recruited science and social studies teachers to participate in this case. Twelve teachers from the 9 elementary schools in the county were contacted and 5 teachers from 4 of the elementary schools responded and agreed to participate in the study. All of the teachers who agreed to participate in this study identified as female and Caucasian. Three out of five of the teachers involved in this study have been teaching in some context for 10-15 years. The remaining teachers have been teaching for 15-20 years and 30-35 years. Almost all of the teachers (4/5) are currently teaching science and two out of five are

teaching social studies. In addition to teaching science or social studies, two teachers in the study also teach language arts or math. Some of the teachers involved in this study work at the same school. The names of the schools at which the teachers work have been withheld so as to maintain anonymity. The demographic information of the teachers involved in this study is summarized in Table 1: Research participants.

Table 1

Research participants

Participant	Subject(s)	Teaching Experience
Teacher 1	Science	10-15 years
Teacher 2	Science and Social Studies	15-20 years
Teacher 3	Social Studies and Language Arts	10-15 years
Teacher 4	Science and Social Studies	10-15 years
Teacher 5	Science and Math	30-35 years

The research participants described above were contacted individually by email (see Appendix A). I provided a copy of the consent document (see Appendix B) as well as additional information about the research. After teachers agreed to participate in this study, I received permission from their schools to conduct the research. Permission for this research was granted by the Ohio University Office of Research and Compliance (see Appendix C). I then arranged interview appointments with individual teachers that would take place at their school of residency during school hours.

Data collection

Over the course of two months, I met with teachers individually and conducted single, semi-structured interviews. Prior to each interview, I reviewed the consent form with the teachers and they signed the form agreeing to participate in the research study. All of the interviews were semi-structured, informal, and guided by an interview guide (see Appendix D). I recorded the interviews using a portable voice recorder and also took hand-written notes. Two of the interviews could not be recorded because of technological difficulties. The interviews started with questions about participants' teaching backgrounds and naturally progressed to the topics of curriculum development, sustainability, and teaching practices. While topics and questions were outlined in the interview guide, all of the interviews progressed organically based on the experiences of the teacher and the shared experiences of the teacher and the researcher. Thus, some of the interviews focused more on certain topics than others but all of them generally covered the intended themes outlined in the interview guide.

After the interviews, I listened to the interview recordings and reviewed the interview notes. I typed up the interviews verbatim and distinguished notes and memos from the interview transcripts. These transcripts were labeled and saved on my personal computer for analysis.

Data analysis

The data collected for this descriptive case study was analyzed through inductive analysis (Merriam, 1998; Emerson, Fretz, & Shaw). I read and re-read the interview transcripts in order to be immersed in the text. After initial reading, I began to code the transcripts and, as I read through the transcript, I highlighted sections of text and ascribed

a code or codes to the text sections. Using this process, I identified major codes and grouped the codes together into categories. I then went through these categories and looked for the emergence of themes and subthemes. I reviewed and restructured the themes and subthemes, searched for outlier and contradictory themes, and re-reviewed and re-restructured the themes until I was able to solidify the themes. I then organized the themes and, again, re-viewed, re-evaluated, and revised them. The themes that emerged from this case study are presented in the following chapter.

CHAPTER 4: FINDINGS

Introduction

Through interviews with Grade 5 science and social studies teachers in Athens County elementary schools, this research explored the various factors that influence whether and how sustainability education is currently being taught in the classroom and avenues for further integrating SE into the curriculum. This chapter presents the themes that emerged from coding the interview data. In the first part of this chapter, "Definitions of Sustainability", I discuss the following themes: 1) Teachers are not formally trained in sustainability or SE; 2) Sustainability is an abstract concept that is difficult for teachers to describe; 3) Teachers frame SE in terms of the effects humans have on ecological system; and 4) Teachers frame sustainability in terms of the interconnectedness between human and ecological systems. In "Feasibility of Sustainability Education", I discuss the following themes: 1) Teachers' ability to practice SE is informed by institutional drivers; 2) Teachers question the appropriateness of SE for their students; 3) Teachers' innovative teaching methods can provide the foundation for SE; and 4) School resources and community partnership provide opportunities for teachers and SE. This chapter concludes with a summary of the themes that emerged and an introduction to the implications of the findings of this study.

Perceptions of Sustainability

The results of this research indicate that teachers' perceptions of sustainability are informed by the convergence of multiple factors. This section outlines how teachers developed their understanding of sustainability, how they articulate the concept of sustainability, and how they present sustainability in the classroom.

Theme 1: Teachers are not formally trained in sustainability or SE

None of the teachers involved in this study had formal training in sustainability or sustainability education. When asked about how they learned about sustainability, teachers described their knowledge stemming from the culmination of direct and indirect experiences. The experiences described by the teachers are informal and, upon critical examination, they do not appear to provide teachers a rich understanding of the interconnected concepts that make up sustainability.

Two of the teachers attributed their conceptions about sustainability to the culmination of indirect experiences largely rooted in changes they observed in society. When asked about how she learned about sustainability, Teacher 2 described initiatives she saw taking place at the local university over time:

> When I went to the university—I went to OU—and I'm so impressed every time I'm there [now because] they have recycling bins everywhere. That was no such thing [when I was there]…I mean I don't even think there was such thing as community recycling. The big thing was cigarette butts are trash. You'd have a big wall of cigarette butts that was the biggest push. Oh and the ozone layer…that was a new thing. (Teacher 2, Science and Social Studies)

In this excerpt, Teacher 2 is describing the emerging presence of recycling and the push for waste disposal that is not littering. She also alludes to the ozone layer and is likely referencing the developing awareness of how humans are disrupting the ozone layer. Teacher 5 also attributed her understanding of sustainability to emerging initiatives for waste reduction:

I first learned about sustainability in general maybe thirty-five [or] thirty years

ago…it was just the time…Earth Day and all that was a big thing.[The more I

learned about it, the more it] seemed to be a reasonable way to go…[By the] time

I had children things like that became important…I thought 'What do I need to do

personally?'…[Back] when my kids were teens, they got home [one day] and

[there were] no more paper napkins, no paper plates on daily basis. [We started]

not using throwaway [products and using] paper cloth napkins [instead]…little

way to start that. They would say 'look how many plates to wash mom' and I'd

say look how little is thrown away! I take sustainability more personal now that I

am getting older. [I think] 'what happens if we keep doing this?' Things I never

touched on [before]…disposable baby diapers [were not an issues]. Most of what

I grew up with was non-disposable. Now things are disposable. At first landfills

were thought to be ok…we thought it would disintegrate. Science now tells us

that it doesn't because there is no air. So I started talking about that [at home and

at school]. (Teacher 5, Science and Math)

Teacher 5 is recounting how the rising presence of "sustainability" in society led to her

awareness of these issues and motivated her to re-evaluate her use of disposable products.

Thus, her understanding of sustainability was informed by her personal responses to

informal observations. These examples are related to human effects on the environment

and the need to alter human behavior to accommodate a growing understanding of the

relationship between human and ecological system. While recycling, waste disposal,

waste reduction, and emissions are important aspects for a sustainable society, these

examples are not descriptive of sustainability. Sustainability is contingent on the

interconnectedness of environmental, social, and economic systems—it is a product of the aggregate—and, therefore, it cannot be authentically defined or understood through isolated examples. In other words, sustainability is not *just* recycling; it involves many integrated systems including waste, water, food, and energy.

Two of the teachers said that they first learned about sustainability through a specific experience. In the following vignette, Teacher 2 describes a field trip she and her daughter took to a educational event at the local high school:

I guess my awareness began…I'm embarrassed to say this is why…Eleven or ten years ago…The high school does water fest…[with] all of these little stations…set up around their field and you go and you learn about different things. One of them was recycling…[the presenters] said to the kids –I was teaching…my daughter was in kindergarten—and they said 'How many of your families recycle?' We don't recycle. I'm panicking thinking that…I'm imagining my little kindergartener being asked and my kindergartener being the only one that doesn't recycle *slams hand down on table* we've got to start. We have got to start! (Teacher 2, Science and Language Arts)

In this passage, Teacher 2 connects an experience that motivated her to recycle to her understanding of sustainability, showing the importance of personal responsibility. As described earlier in this section, recycling in and of itself cannot indicate an understanding of sustainability. Teacher 1 also had a specific experience that inspired her to make changes in her life. She describes her experience at the Ohio University Ecohouse, a university operated student housing and sustainability education center, in the following episode:

About eight years ago I visited the Ecohouse at OU. We took a trip there [with our school]. At that time I really did not know much about sustainability and [through that experience] I saw and learned a lot. That [trip] really planted a seed [in me] and from there when I would hear something, read something, see a group of people, read a bumper sticker—just little things throughout—I would pay attention to it and kind of gathered my knowledge that way…I think that living here in Athens County if a person chooses they can really surround themselves with like minded people and I've tried to do that. (Teacher 1, Science)

In Teacher 1's circumstance, a direct experience led to a heightened awareness of the prevalence of sustainability in her community and a desire to learn more about the issue. Teacher 1 did not elaborate on the specific insights she received from her experience at the Ecohouse. Teacher 1's visit to the Ecohouse likely involved a holistic description of sustainability given the mission of the Echohouse. However, the transference of the principles of sustainability was not present in Teacher 1's account of her experiences, her definition of sustainability, or her teaching.

Given the context in which teachers attributed their understanding of sustainability and the insights they presented, the experiences described by the teachers would more accurately be described as the development of an understanding of environmentalism. While elements of environmentalism are connected to sustainability they do not equate to sustainability because they do not address the interconnectedness of environmental, social, and economic systems. Despite the fact that teachers in this study did not learn about sustainability or sustainability education formally, their overall understanding of sustainability cannot be staked to their initial insights on the topic.

The experiences described by these teachers cannot be taken as indicative of their current perceptions of sustainability. These experiences may simply signify when teachers first started becoming aware of sustainability issues and, due to their episodic nature, they may stick out in teachers' minds as being important indicators of their personal journeys towards understanding sustainability. In other words, they may in a way be the catalysts that set teachers on the path of sustainability and the associated value of these stories deemed them worthy of including in their personal narratives. The following section explores how teachers articulated their current perceptions of sustainability.

Theme 2: Sustainability is an abstract concept that is difficult for teachers to describe

The teachers involved in this research expressed uncertainty when asked to describe sustainability and provided abstract descriptions of the concept. Their discomfort in talking about sustainability was illustrated non-verbally, through their body language, and verbally through pauses and hesitations between words. It is likely that the teachers involved in this study had never been asked, on the spot, to describe sustainability or how their teaching might address sustainability issues.

Teacher 5 (Science and Math) explicitly stated that she did not feel comfortable providing a "flat out" definition of sustainability and expressed that she did not have one.

After a nervous laugh and a half-joking question of "Do I have to answer that?" Teacher 2 (Science and Social Studies) paused and looked at me with a smile and pleading face. I prompted her to address the question the best she could and she then proceeded to quickly and nervously piece together a reply that involved recycling as a method for "saving the earth" and "making the earth a beautiful place." These comments

are non-specific in nature and do not speak directly to the breadth of sustainability. Teacher 2's focus on caring for the planet for the sake of "saving the earth" is more closely connected with environmentalism than sustainability.

When asked how she would articulate the concept of sustainability, Teacher 4 was originally wary (as expressed through prolonged pauses and "ums") but eventually replied in a manor that was simultaneously cautious and nonchalant, occasionally glancing at me as if looking for signs of approval:

Sustainability is like being able to sustain. You know, make your own things and take care of yourself and not rely so much on the outside world I guess is what I've heard more of…everything connects…it's just how things are." (Teacher 4, Science and Social Studies).

Teacher 4's description of sustainability is generalized and grounded in catchall phrases. She alludes to sustainability as a way of self-reliance but she does not specify what self-reliance would entail.

Teacher 1 addressed the question of sustainability with a calm composure. Her eyes would occasionally close in contemplation and I felt that I could see her weaving concepts together in her head as she replied:

For me it just means that we have something and we're using it in a way that we will continue to have it…but [it is also] so much more than that. Sustainability is a sort of lifestyle...and we can't put it into a sentence. It's more than that. For me it's everything from the box turtle to gasoline to water…I mean it's everything. (Teacher 1, Science)

Teacher 1's presentation of sustainability alludes to the long-term implications of sustainability. She elaborates in an attempt to express how sustainability is "so much more than that" and that the concept is difficult to define because it encompasses "everything." Her description of "it's everything" is a little more specific than Teacher 4's in that she mentions some qualifying examples. These examples, however, are still vague and do not clearly articulate the social, economic, and environmental factors of sustainability.

When asked to describe what sustainability meant to her, Teacher 3 took a long pause and said:

> Sustainability is about being a good citizen and being aware of issues…[Good citizens] have a vote that is a right but also a responsibility…Things that good citizens do [are important because they] promote town clean up [and] promote recycling. (Teacher 3, Social Studies and Language Arts)

Teacher 3's definition of sustainability abstractly speaks to the social responsibility aspects of sustainability and the relationship between citizens and the environment. Her comments are more in line with Teacher 2's comments about "making the earth a beautiful place" than making the world a socially, economically, and environmentally just and sustainable place.

Overall, teachers' descriptions of sustainability were vague. While the essence of teachers' remarks spoke to the relationships between human and ecological systems, none of the teacher elaborated on the social or economic factors that affect ecological or human systems. The interconnectedness of social, economic, and ecological systems is central to the concept of sustainability. Evaluating teachers' perceptions of sustainability

solely based on their impromptu descriptions may not be an accurate presentation of their understanding, especially given the hesitation teachers expressed when asked to define sustainability. The following section explores the lessons teachers related to sustainability education. Their responses elaborate on how they perceive sustainability.

Theme 3: Teachers frame SE in terms of the effects humans have on ecological systems

When asked to describe lessons that embodied sustainability, teachers predominantly responded with examples that focused on how humans negatively affect ecological systems and some of the ways in which humans can alter their behavior to reduce their burden on ecological systems. While the lessons teachers presented were inherently tied to social and economic drivers and outcomes, the teachers did not specifically mention these aspects, focusing solely on the ecological implications. Thus, teachers framing of sustainability is hindered by the absence of connecting ecological aspects with social and environmental aspects.

Some teachers described the detrimental environmental effects of logging, coal mining, and energy use. It is important to note that these are descriptions of past or current practices and that the actual lessons in the classroom may have addressed more than just the environmental aspects of these issues.

In the following excerpt, Teacher 1 presents a lesson on the effects that logging can have on habitats and species populations:

> We discussed the old growth forest and how people…have ruined them from [logging] and…then saved it…and [that] some species are extinct because of habitat loss [and how] a lot of that is because of humans. So I will talk about humans in that regard but in the new generation standards, linking humans

directly [to habitat destruction] is not written in there. I'll talk about it because

how can you not. I mean how can you talk about endangered species…you cannot

talk about endangered species without talking about the effects of humans…[the

old standards required that the students] know there are changes to the

environment [and that] some changes are beneficial [and] some changes are

detrimental…some changes are rapid and some changes are gradual. (Teacher 1,

Science)

As shown in this lesson, Teacher 1 focuses on how humans are disrupting ecological

systems through the process of logging. She passionately expresses the importance of

making the connection between human activity and endangered species connections,

despite the fact that this connection is no longer included explicitly in the state standards.

Teacher 1's lesson could have been a more authentic representation of sustainability, and

arguably a more informative lesson for her students if she included the economic and

social drivers and outcomes of the logging industry. This would have provided her

students with the context of *why* the logging of old growth forests is happening in the first

place.

Teacher 4 described the detrimental effects humans can have on the environment

in the context of mining for energy:

Occasionally if it comes up we'll talk about that this was a mining area…that you

know black diamonds…little black diamonds…[we] talk about the creeks and

how some of them…because the mining happened you can see the yellow and the

sulfur and the effects of the mining from back then. (Teacher 4, Science and

Social Studies)

Teacher 4's example focuses on an issue that is very applicable to the population of her students given the history of coal mining and acid mine drainage in the region. Teacher 4 does mention the people that live in the area affected by acid mine drainage but she does not specifically focus on the economic and social drivers and outcomes of the industry. This lesson could have been elaborated, for instance, by describing the effects of mining on communities, human health, and the economy.

Teacher 5 presented a lesson that related human energy use to air pollution:

In physical science [I did a lesson on] heat and light…[We talked about] where heat comes from for homes…different sources…[and] how we're lucky here because we have different heat sources. We talked about how different heat sources help or hinder the environment. [I told the kids] how we put a wood burner in our house [and that we thought it was] good but turned out to have pollution. (Teacher 5, Science and Math)

In her lesson, Teacher 5 describes how humans have choices between energy sources and how these choices can have different environmental outcomes. Again, what is missing from this teacher's description is the highlighting of the social and economic drivers and outcomes that influence the availability and efficiency of energy systems.

Some of the teachers that presented sustainability in the context of the detrimental effects of humans on the environment included recommendations for how humans could alter their behavior to limit the detrimental effects of humans on the environment in their lessons. The following lessons illustrate how teachers presented human initiatives (i.e. ecological design, recycling, alternative energy) as avenues for a more sustainable future.

In the following excerpt, Teacher 4 presented a lesson on how ecologically informed landscaping choices can be more environmentally sound:

We talk about biomes and climate and how what your area has is different than [other areas]…like if I live out in the desert then I don't want to have green grass even though people try to so that you want to have a natural habitat in your yard, not one that you've put in yourself…the animals and the environment is better for that…and that if you put fertilizer…if you use too much [it] is bad for the environment and it will affect the water and then ponds and then the fish and then all the animals…so [we talk about sustainability in] that way (Teacher 4, Science and Social Studies)

In this example, Teacher 4 described how refraining from the culturally dominant aesthetic of "green grass" and instead having a more place-based, ecologically appropriate landscape, humans can limit the impact they make on ecological systems. This lesson could have been improved by the incorporation of the social and economic dimensions of human designed landscapes.

Teacher 3 also described a lesson that spoke to the potential benefits of place-based, ecologically informed design:

I had them make model dwellings out of dough and different materials. [The lesson showed] how different regions used different resources [that were locally available] to live. We made some connections to how people actually live [and that] people are still living like this today even here …it's not [something ancient] it's practical. (Teacher 3, Social Studies and Language Arts)

In this example, Teacher 3 expressed how using ecological available materials is more sustainable than outsourcing resources. This lesson could have been expanded by included the social and economic factors that influence why certain materials are sourced for housing and the implications of this process.

Another example lesson of sustainability education is a solar cooker activity that was facilitated as part of a physical science unit in the classroom of Teacher 5 (Science and Math). She described how her student teacher had the class make a solar cooker. They talked about how cooking with solar energy, as opposed to energy derived from fossil fuels, can be less detrimental to the environment.

Teacher 4 (Science and Social Studies), mentioned how she used to show her class a movie on how recycling is beneficial for the environment. She describes the lesson in the following passage:

Why – why is it important for us to do this, what are we doing…where is all of this going? How is that affecting the soil? How does that affect the plants? You know we talk about it a little bit. I don't know that I have ever put it on so personal…an accountability or responsibility type of presentation. In the past I have used a movie…[The Earth Day Special]…it is very cute but it is not set up really as a responsibility type it is more the story of why you should [take care of the environment]…[one character] is mother nature and she is dying and [one character] is like the keeper of the town and he doesn't care. He thinks all this recycling is stupid and then the kids come in and start talking about how recycling is important and it kind of goes through star to star and scenario to scenario...they

just go through and finally convince [the keeper of the town] that recycling is important and they save mother nature. (Teacher 4, Science and Social Studies)

Teacher 4 connected the concept of interconnectedness of ecological systems to actions like recycling to show that human actions are indeed important and can make lasting effects on the environment.

Overall, the lessons described above speak to the potential positive outcomes of ecologically informed decision making. The teachers provided concrete examples that students could relate to and use to develop their ideas about the impacts human systems have on ecological systems, and how those impacts can in turn affect human systems. However, while the lessons described the detrimental affects of humans on the environment, these lessons could have expanded on the social and economic aspects of human-environmental relations. The following section presents how some teachers incorporated social, economic, and environmental aspects of sustainability into their curricula.

Theme 4: Teachers frame sustainability in terms of the interconnectedness between human and ecological systems

Two of the teachers in this study framed sustainability in a way that demonstrated the interconnectedness of social, economic, and environmental aspects of sustainability. The lessons presented by these teachers evoked the complexity of sustainability issues and the factors that inform sustainability-based decision-making. Both of these teachers described lessons that were place-based in nature and focused on the concepts of energy.

In the following passage, Teacher 4 talks about how environmental, economic, and social factors influence the energy choices we make:

We talk about resources and how everything is connected…I mean…if they don't

understand that then they are not going to understand how to take care of the

environment and the world because it's all connected…it's connected to solar

energy and pollution and jobs…we also talk about the fact that you know we

don't want to rely completely on solar energy and wind power we also want some

coal. We've talked about that and some of the kids have brought up like if we

don't use coal at all that is a lot of jobs so then that is going to affect our

economy…I mean it's just it all is connected and we have to think about how it is

connected and how it is going to affect everything you…if we don't you're going

to end up with a problem. (Teacher 4, Science and Social Studies)

In this lesson, Teacher 4 describes the challenges society faces when it comes to making

choices about energy. She uses a place-based example that is relatable to the students in

her classroom who are familiar with the coal mining history of the area and the present

debate about what factors should ultimately inform energy choices. This lesson facilitated

a dialogue about the issues and spoke to the importance of considering how to make a

sustainability-informed decision. While Teacher 4's example included social, economic,

and environmental factors, the lesson did not provide as much depth and breadth as

Teacher 3's lesson.

In the excerpt below, Teacher 3 describes a lesson she facilitated on the issue of

hydraulic fracturing:

I had them write persuasive essays on fracking. [It's a] hot topic. Some [students]

know about it [or know their] parent opinions. We watched some online videos

about the process when the debate was going on [locally]…after the arrests [of the

protesters at the injection well]. I had a panel come [including] WOUB, the Ohio

Department of Natural Resources, Athens Soil and Water District, and a

watershed group. The watershed group brought in a water table display and

showed how fracking could affect the water supply. [The students] had to vote

and decided [whether or not hydraulic fracturing or injection wells should be

allowed in the county]. Three said it was okay. Forty said it was not okay.

(Teacher 3, Social Studies and Language Arts)

The lesson described above is an example of sustainability education because it addressed

the social, economic, and environmental aspects hydraulic fracturing and how the

culmination of social, economic, and environmental issues is critical for decision-making.

This lesson is also exemplary because it utilizes place-based and critical thinking

pedagogies and collaborations with community partnership. The structure of the lesson

(i.e. use of a panel to provide information about the issue, incorporation of democratic

decision making techniques) was an excellent example of how informed decisions are

determined.

Teacher 3 did not elaborate into much detail, beyond what is presented in her

excerpt above, as to the specific roles of the panel members. However, given the focus of

the panel and the expertise of the various groups that served on the panel, the potential

points of discussion can be inferred. The Athens Soil and Water District and the local

watershed group were likely able to speak to the environmental aspects of the hydraulic

fracturing debate. The Ohio Department of Natural Resources was likely able to provide

additional insight into the environmental aspects of hydraulic fracturing as well as the

economic drivers of the industry. WOUB, the local news station, was likely able to

illustrate how the issues of hydraulic fracturing are presented in the media and citizens'

responses to these issues, thus covering some of the social aspects of the issue including

concerns for human health and the effects the industry would have on the community.

Teacher 3 did not specify what her exact role was in this lesson, whether she was

an organizer or whether she actively participated in aspects of the presentation or

discussion. While this type of lesson may be an exceptional example of sustainability

education, lessons like these may logistically only happen a couple of times per year. It is

evident that these types of lesson required an immense amount of planning and outside

expertise. Unlike Teacher 4, Teacher 3 called in assistance from outside organizations

and entities to provide their expertise on the various aspects of the subject matter. It is

plausible that the breadth and depth to which the integration of environmental, social, and

economic factors were presented was contingent on the assistance the community.

While the lessons described by both Teacher 4 and Teacher 3 show that the

integration of sustainability into the classroom is possible, they also demonstrate the time

and resource demands of preparing such lessons. The following section explores the

factors that influence the feasibility of sustainability education in elementary curricula.

<center>Feasibility of Sustainability Education</center>

The results of this research indicated that there are factors that influence whether

and how sustainability education can be implemented into science and social studies

classes. Teachers in this study said that their implementation of sustainability education

was challenged by the requirements of the state standards as well as their perceived

appropriateness of sustainability education for their students. The results of this research

indicate that there is potential for sustainability education given the existing teaching methods, visions, and community collaborations of the teachers involved in this study.

Theme 5: Teachers' ability to practice SE is informed by institutional drivers

The teachers involved in this study expressed that their ability to teach sustainability education in the classroom was limited by the demands of the education system. Teachers described how the standardized testing schedule and progress reporting were generally challenging for them but that the state standards were what fundamentally hindered their ability to explore options for teaching SE.

All of the teachers involved in this researched described how the state standards were the ultimate driving force of their curriculum and that, since sustainability is not included in the standards, teachers are not required to teach it. The teachers said that while there is room for "supplemental enrichment" in their curriculum, these topics are not covered until after all of the material in the standards, which is necessary for testing, is covered. Teacher 1 summarizes these points in the following excerpt:

> This is my state standards and this is what drives everything I do. I really have no choice this is state mandated. So if sustainability is not in this list I can teach it and call it supplement enrichment but I need to be able to tie it back [in with the standards] and I'm not going to teach it until everything in this list [the standards] has been learned and mastered for our state exam. (Teacher 1, Science)

None of the teachers involved in this study specifically stated that they were actively teaching sustainability as part of their supplemental instruction. When asked about what material they were teaching for supplemental enrichment, the teachers responded that they were teaching material that was of interest to them or of interest to their students.

Teacher 1 highlights the potential challenges that emerge when important topics are not present in the state standards and are left for supplemental enrichment:

> I would assume every teacher you are going to encounter in the state of Ohio is going off of this and when they do have room to supplement they are going to supplement with things that interest them and if a teacher is not interested in metamorphosis she is not going to choose that to supplement or she or he is going to choose a different topic to supplement so metamorphosis is gone. When you are relying on the teacher just having a light bulb moment of 'Oh I better teach metamorphosis' that may or may not happen. It depends on their interest…If it is not written in these state standards it may or may not be covered by that particular teacher that particular year. The only thing we can guarantee is that everything in here [the standards] is covered. (Teacher 1, Science)

Teacher 1's remarks can serve as a reference point for the limitations of sustainability education being absent from the standards. From this example, we can infer that if teachers are not interested in sustainability they are not going to teach it as supplemental instruction. Thus if sustainability is not in the standards and if teachers are not interested in sustainability education, the likelihood of sustainability education in the classroom is limited. Teachers inclusion of sustainability into their curriculum may also be limited if they perceive sustainability as a topic that is intellectually inappropriate for their students.

Theme 6: Teachers question the appropriateness of SE for their students

The teachers involved in this study questioned whether or not sustainability education was appropriate for their students. Some teachers perceived the concept of sustainability to be beyond the intellectual capacity of their students. Other teachers noted

that sustainability issues might be too emotionally demanding for their students. Their

remarks are described below. The teachers that expressed these concerns did not specify

when an appropriate time would be to teach students about sustainability issues.

One of the teachers expressed hesitation towards teaching sustainability education

in her classes because she perceived the higher level thinking associated with

sustainability education to be beyond the intellectual capacity of her students. Teacher 4

elaborates on this concern in the following passage:

Like my government units I have to teach…the difference between monarchy,

dictatorships, and democracy…I mean I suppose we could talk about 'suppose we

do this with sustainability how would each government react?' but that is pretty

high level thinking for fifth grade. When, right now they have never even heard of

monarchy. To them that is a butterfly... [In] history…I'm looking at Native

Americans. Sure, 'how did they use their resources? They use all the parts how

does that relate to us?' That relating to us…a little higher-level…Yeah they have

to…know…that they used all the parts when they would go on a hunt... That

could be a quick side note you know 'look at how they...look at that! When we do

something like that we should use all of the parts too.' But that is really about as

far as we would [go]…it's just kind of a touch here and there…[but the fact] that

that level of thinking right now [is] that abstract…is difficult. Most 5th graders at

this point it needs to be it's own 'we're talking about saving the earth what can we

do to make the earth a beautiful place when you're my age' and then you spend

five minutes 'how old are you?' (Teacher 4, Science and Social Studies)

Teacher 2's remarks demonstrate her uncertainty about the place of sustainability education in her lessons. Through her example of the potential for sustainability in lessons on monarchy, dictatorships, and democracy, she expressed how her students could likely not extrapolate complex, deeper meaning from concepts they do not understand. Her example on Native Americans highlights potentials for "quick side notes" on the subject but that that is about all her students are capable of learning. While she states that she could "pull in" sustainability concepts into her lessons, the overall essence of her remarks is that sustainability education is not feasible due to the intellectual capacity of her students. Her remarks indicated that she did not want to challenge her students with sustainability education.

Two teachers described how they saw sustainability as an issue that may be beyond the reach of their students due to other issues her students are facing in their lives. Teacher 3 talked about how a majority of her students are living in poverty and that many of them are having to worry about food, clothing, housing, and family relationships. She stressed that a lot of her students have to take on a lot of independence and responsibility and that she is worried about what their home life might be like. These remarks were not made as an objection to sustainability education. In fact, Teacher 3 expressed that she felt sustainability education could be helpful for her students. One example she mentioned was that students learning how to grow their own food could reduce hunger, increase nutrition, and decrease economic strains. However, she said that these goals might be beyond the scope of what she as their teacher could bring to her students. Teacher 2 echoed these remarks:

Sustainability is not a priority and there are a lot of our students [that] have much

higher priorities than they should. We have a rough population but to have

something that they can control even [something like] 'I'm going to take this and

I'm going to put it in the recycling and look what I've done today' – have that

little piece but of course teaching them recycling is not a difficult thing time wise

but to then stem from there…(Teacher 2, Science and Social Studies)

Through her insights, Teacher 2 expresses how although her students have a lot going on

in their lives, sustainability could be an outlet that provides them a sense of meaning and

purpose. Thus, although there a lot of conflicting factors in regards to the place of

sustainability education in the elementary classroom, there are some perceived benefits.

Theme 7: Teachers' innovative teaching methods can provide the foundation for SE

Over the course of the interviews, teachers presented lesson examples that

included innovative teaching methods associated with sustainability education teaching

models. Many of the examples described in the context of sustainability education at the

beginning of this chapter utilized place-based methods, experiential and participatory

processes, and diverse and critically questioning frameworks. Throughout their

interviews, teachers expressed how they value these methods and incorporate them into

their teaching practice.

The lessons described below exemplify how teachers' value and use these

teaching methods outside of the context of sustainability education. In the follow excerpt,

Teacher 5 describes how she has come to appreciate the value of innovative teaching

methods:

When I used to teach science projects it kind of ended up that projects were all

posters. Nowadays, you finish studying minerals [and the lesson can culminate

with] plays, poetry, computer power points, and songs. [These projects] involve

everybody…many students that weren't involved [in previous years] are now

excited about being involved. And they remember when they are excited. I think

it is a good way to teach…longer way but good way. (Teacher 5, Science and

Math)

Teacher 5 acknowledges the value and difficulty associated with this style of teaching.

The driving force for using these methods is to help the students learn in way that is fun

and creative and leads to meaningful, long-lasting learning experiences. Teacher 4 also

described how her students appreciate learning through these methods:

As a teacher you have to constantly be evolving...[the students] have to be excited

and want to learn all the time…And so it is just constantly making everything

connect to a whole bunch of different things so that you can get everyone to

connect to it and buy in. They all learn differently and they want to touch. They

all have these different interests and past experiences and life experiences. That is

a big part of science and social studies too is that we do a lot of discussions in

class and they bring out their life experiences…'Oh I've been here I saw this, oh

that ties with…' so it's just constant...If they don't have any experiences then I

have to bring things in to make that but if it's constantly me saying 'well, I went

here and this happened' then it just doesn't mean the same for them as if they say

'oh Fred went to California and he got to see a volcano or he got to see the San

Andreas Fault and he said…' (Teacher 4, Science and Social Studies)

In this excerpt, Teacher 4 described the importance of hands on learning and learning from past experiences. Teacher 1 also explained how she tries to make connections between what students are learning outside of school and what students are learning in the classroom. She described how she has a shadow box in her classroom specifically for students to bring in artifacts they find in nature and how she will tie lesson material in with the objects students bring. Teacher 1 outlines the general design of her classes:

> We do fieldwork a lot. In the fall we are outside at least once a week. The kids take field notes…until the snow is flying [and] we can't stand it anymore we're outside and then as soon as the field dries out [in the spring] we'll be outside looking for habitats and studying the ecosystem until school is out. They'll have field notes and take a clipboard and they have…different criteria that they're trying to find. For example, if we are studying habitats they'll do sketches and labeling. They will write down evidence, they'll make some…analysis…I try to do a lot of higher thinking with this. You know, a question might be 'what if the dragonflies were removed from the ecosystem...what would happen to the rest of the organisms' so I try to do that kind of thinking but there is also just a fill in the blank type questions. And then they'll turn those field notes in at the end of the hour and then that would be their grade for that class. (Teacher 1, Science)

This passage illustrates how Teacher 1 is using experiential and critically questioning teaching methods for her classes.

While the example lessons described by teachers are not specific to sustainability education, teachers' interest in and value of these teaching methods proposes that teachers may be apt for teaching sustainability education if the opportunity was presented

to them. The following section explores educational opportunities of interest for the teachers in this study.

Theme 8: School and community resources provide opportunities for teachers and SE

The teachers involved in this study expressed the value of place and community resources, in terms of the local environment and community partnerships. Teachers said they were interested in engaging their students with the local environment and enhancing the environmental resources at their schools. Many teachers referred to the assistance that community partnerships could provide for these endeavors. The teachers involved in this study were generally aware of the educational opportunities presented by the community and felt that these programs were both beneficial for themselves and for their students.

Teacher 3 described a greenhouse project she helped try to start at her school in order to enhance the educational opportunities for her students and also provide her students with fresh, healthy produce to eat in the cafeteria. She describes the vision and challenges associated with this project:

> We wrote a grant for a greenhouse but we didn't get it…The Master Gardener's program started [a garden here] but [the program] fell apart. [Some community members] tried to get a grant. Unfortunately during the school year it is not optimal for gardening. There is no one to take care of it in the summer or [continue it]…I think I might have time to garden but it's [a big commitment]…[it] would be a real learning experience [for the students]. Rather than 'write about this' it happens. (Teacher 3, Social Studies and Language Arts).

As seen through this example, Teacher 3 has an interest in using gardens as a resource for education and is familiar with some of the challenges of such initiatives. While she

indicated previous involvement with the Master Gardeners program and community

volunteers, she did not bring up Community Food Initiatives and their school garden

program that aims to assist teachers and schools in creating and maintaining school

gardens and assisting in the development of standards-based curriculum.

Teacher 2 described her interest in environmental resources at her school in the

following passage:

We have a [school] garden…and honestly I don't know who keeps it up or who

uses it right now...I don't know if anyone does…now if there is this huge lush

garden back there I am going to be really embarrassed…I would love to get them

out in the garden and grow things. I mean we have a garden at my house that we

do. I would love to bring that here and teach them how to do those things…how

to grow your own food…how to eat healthier. All of that would be wonderful

because most kids…don't eat very well and especially in our population…Using

the outdoors as a resource does not happen enough. I mean it's not like it can't be

worked in…[it's] just because of the things we are required to take care of

(Teacher 2, Science and Social Studies).

Teacher 2 expressed that she was not up to date on the current state of the environmental

resources at her school. However, she insisted that she would be interested in the

development of these resources for her classes but that she personally is not able to

facilitate this development. Teacher 2 did not seem to be aware of opportunities for

collaboration with Community Food Initiatives' school garden program or Live Healthy

Appalachia's cooking and nutrition program.

Teacher 1 describes interest in enhancing the educational opportunities in her schoolyard:

I'd love to have a butterfly garden. I'd love to plant milkweed all over the place. I'd love to put up a bluebird trail…the younger grades started to put up a vegetable garden. The problem is no one is here over the summer to tend it so…there are things that are kind of floating around in my head that due to money and time it just hasn't happened yet but you know it's possible...it would depend on getting some grants (Teacher 1, Science).

Teacher 1 feels confident using enhanced educational spaces like a butterfly garden or bluebird trail as part of her curricula. The issues that are hindering her ability to teach with these resources is the funding required for the site development and the time for long term maintenance. Teacher 1 does not allude to the fact that she could potentially collaborate with a community partnership to receive grant funding for the installation and maintenance of these initiatives.

Teacher 4 said that she was interested in having a compost pile and garden at her school to use for her curricula:

It'd be nice to have a compost pile without regulations and all that kind of stuff…We do have recycling. And we talked about gardens before it is just trying to figure out the time how to make it work [and] what standards it can go with. (Teacher 4, Science and Social Studies).

While Teacher 4 expressed interest in the use of environmental resources at her school, she did not introduce the possibility of collaborating with a community partnership to help facilitate the instillation of the compost pile and gardens or the development of

curricula. Both projects could potentially be carried out in collaboration with Community Food Initiative's school garden program. Teacher 4 did mention collaborating with Rural Action for assistance with the land lab at her school:

> I'm trying to get us to be able to use [our beautiful land lab] it a little bit more than we have. There are trails and we have the creek with some trees…We had signs that identified trees but the trees are no longer there…The teachers who started it…told me that it is really easy to get a grant to start a land lab [but] it's really hard to get one to do upkeep…I've fallen behind just to get the upkeep. But we have a little classroom out there with a podium and seats and there are all different trails… I have made contact with Rural Action and I'm going to start talking with them about helping out in the land lab and helping us get it back to where we are using it more... I am not able to spend as much time figuring out what to do with the land lab or getting resources to come in…[I don't have] all the materials…(Teacher 4, Science and Social Studies)

Teacher 4 highlighted that Rural Action could assist with the revival and maintenance of the land lab and that this partnership would be incredibly valuable since she does not foresee having enough time or energy, due to institutional demands, to address the project on her own. Teacher 4 was confident in her ability to utilize the land lab once it was restored.

Teacher 5 described her interest in incorporating the local environment into her curricula, but mentioned that she was challenged by the limited resources at her school and the fact that she does not feel she has expertise in utilizing the environment for education:

I don't take my kids outside to look at science a lot. There is not a lot outside so

we don't do that. I don't see that there is a place to do it. We have gone down to

the bike path to look at different plants and different types of habitats. Some days

but not daily or on a weekly basis. I would have to figure out the content...I am

not a true outdoor scientist but my students still deserve to have outdoor

experiences... (Teacher 5, Science and Math)

Teacher 5 recognizes the importance of engaging her students with the local environment

and attributes value to methods of education that incorporate place. She went on to

describe her appreciation for the place-based, sustainability themed field trip I facilitated

for her students at the Ohio University West State Street Research Site:

Our trip to the [Ohio University] gardens was a culminating activity because we

were able to find what we talked about in our books…[and I did not have to plan

it!]...On the exam [that required] higher level thinking…students used exact

examples from the garden and expanded on those examples. I told them 'think

back about what you know what you learning on the field trip'. It was a nice

reference point. It would spark an idea that they go then go off of. (Teacher 5,

Science and Math)

In this passage, Teacher 5 demonstrates how programs offered by the community can

provide opportunities for her students that she feels unable to provide. This initiative,

however, was unique in that it involved the utilization of environmental resources that

exist outside the boundaries of school grounds.

Other teachers involved in this study expressed the value of providing

opportunities for their students to learn about the local environment beyond the confines

of school grounds. Teachers highlighted their appreciation of field-trip opportunities and in-school presentations offered by various community groups in the region. The programs were described as being more feasible, and even desirable, than teachers expending energy to create and maintain educational resources at their school for more regular use. All of the teachers involved in this study had established school-community partnerships with Athens Soil and Water Conservation, and many of the teachers were forging partnerships with other community organizations (i.e. Rural Action, Ohio University).

Teacher 2 illustrated her enthusiasm for the programs offered by the Athens Soil and Water Conservation:

> I think that programs...freshen things up for the kids for the teacher. I love when [groups like] Athens Soil and Water come. I mean it may be only two or three times a year but [it was] wonderful [they] were really good. She was young…I would imagine she moved up and beyond our little neck of the woods. (Teacher 2, Science and Social Studies)

While her remarks are generally supportive of school-community partnerships and the overall value they are to her students, she allude to the potential inconsistency and impermanence of such programs.

Teacher 4 described her appreciation of existing community partnerships and interest in new partnerships in the following passage:

> I've had OU students come in before and teach some biology lessons with the students…it just depends on each year and on what comes across my desk…who's offering what. Athens Soil and Water comes every year. I mean that is just a standard thing…Some things like you…wanting to have us come [to the

garden]…we [can] try it out and then go from there…if it is something we want to do each year. Our scheduling is different each year. We go to an outdoor education camp at Camp Oty'Okwa for three days…I don't bring people in as much because we go there for 3 days and they have councilors and they do geology, stream ecology, and insect studies… all kinds of classes…So that takes a big chunk of time and planning…(Teacher 4, Science and Social Studies)

Through her remarks, Teacher 4 describes her interest in community offerings, the value of these programs, and the relative ease of forming school-community partnerships.

The remarks of these teachers indicate that there is interest in enhancing the educational resources in their local environment and in their community. The teachers lamented that with these opportunities, there are also challenges. The resource use described by the teachers are not directly linked to a socially, economically, and environmentally grounded framework for sustainability education; they mostly adhere to the environmental domain of sustainability. However, with guidance, the instillation or revival of butterfly gardens, native plants, school gardens, compost piles, and land labs could be avenues for sustainability education. Additionally, sustainability education could be embedded in the potential or existing partnerships with Rural Action, Athens Soil and Water, Live Healthy Appalachia, Ohio University, and Camp Oty'ochwa.

<div align="center">Summary</div>

This chapter outlined the combination of factors that influence whether and how sustainability education is being taught by Grade 5 science and social studies teachers in Athens County elementary schools and provided insight on the potential space for sustainability education. The results of this study indicated that the teachers in this study

have not been formally trained in sustainability or sustainability education and that their perceptions of sustainability are largely grounded in environmental dimensions. Teachers are not familiar enough with sustainability to define the concept in a way that clearly speaks to the interconnectedness of the social, environmental, and economic aspects of sustainability. When describing examples of teaching SE, the lessons teachers presented reflected their environmentally focused perceptions and, therefore, were more aligned with the principles of environmental education that sustainability education. However, two teachers in this study described lessons examples that embodied the social, economic, and environmental aspects of sustainability. The ways in which teachers defined sustainability and presented sustainability in their classroom were consistent with the ways in which teachers learned about sustainability; the focus was on the environment.

The second part of this chapter investigated the feasibility of sustainability education in Athens County Grade 5 science and social studies classrooms. The teachers described how they were limited in their ability to teach sustainability due to the confines of the state standards. Some teachers also expressed that they found the concepts embedded in sustainability education to be beyond the intellectual and emotional capacity of their students. This chapter concluded with an exploration of the factors that may indicate a potential for sustainability education in the classroom. This section showed how teachers' incorporation of and excitement about innovative teaching methods and community partnerships may be avenues to some type of inclusion of sustainability education in Grade 5 science and social studies classes in the county.

Conclusion

The results of this study indicate that there is space for sustainability education in Athens County Grade 5 science and social studies classes. The teachers involved in this study were passionate about their teaching and the potential impacts their teaching can have on their students. The teachers used innovative teaching methods to provide transformative education opportunities for their students, going above and beyond what was required of them by the state standards. In terms of content, teachers valued teaching their students about the relationships between humans and ecological systems and how humans impact and are impacted by their environment. While most of the teachers involved in this study had not specifically taught their students about sustainability, they illustrated how they are teaching concepts that are related to sustainability and they expressed how they are interested in teaching sustainability. Since sustainability is not included in the state standards or teacher preparation programs, the space for sustainability education may be in the form of add-on programs provided or presented by external organizations (i.e. non-profit, university, or community collaborations. The following chapter explores the implications of the research findings and how they relate to the key concepts in the literature review.

CHAPTER 5: DISCUSSION

Sustainability is arguably the most pivotal issue of our time. Indeed, it is no longer a question of whether or not we address the issues of sustainability, but more so how quickly and broadly we address sustainability to ensure the survivability and resilience of the human species in a socially, economically, and environmentally sustainable world. Sustainability education is an avenue towards a socially, economically, and environmentally just and sustainable future because it provides the foundational understanding necessary for action.

The purpose of this study was to determine the space for sustainability education in the public education system. This study focused on Grade 5 science and social studies education in Athens County elementary schools and investigated whether and how sustainability education was currently being taught as well as the opportunities for additional implementation of SE. Using the case study methodology, this research looked to practicing teachers for insights on how sustainability education could be further integrated into the public education system. This research was guided by the following research questions:

Q1: What are teachers' perceptions of sustainability?

Q2: What challenges and opportunities facilitate teachers' practice with respect to sustainability education?

Q3: What, if at all, approaches do teachers use to teach sustainability education? This chapter relates the results of this research with the findings from the literature review, presents the insights and implications of this study, outlines the limitations of this study, and provides recommendations that meet the issues raised in this study. Next, this

chapter illustrates my role as the researcher, and the assumptions, experiences, and understanding that I came into and came out with over the course of this study. Lastly, this chapter presents avenues for further research and summarizes the findings of this research.

Findings and Interpretations

Perceptions of sustainability

Theme 1: Teachers are not formally trained in sustainability or SE

The teachers involved in this research associated the development of their understanding of sustainability to direct and indirect experiences. While there are studies on SE in teacher education programs and how teachers are able to learn about SE through these programs, there is no literature available on how teachers learn about SE in other contexts. None of the teachers expressed that they learned about sustainability or sustainability education during their pre-service education. Given the general absence of SE in teacher education (Fein & Maclean, 2009), this finding is not surprising.

Despite the fact that the teachers involved in this study were not trained in, or familiar with, the concept of SE, this study found that some of the teachers were teaching aspects of or detailed approaches to SE. This phenomenon is consistent with Vosburg-Bluem (2012) findings that many teachers may be teaching sustainability education, or aspects of sustainability education, without knowing. While teachers were able to teach aspects of SE without formal training, the following section shows how teachers' lack of formal training in SE is evident and compromising.

Theme 2: Sustainability is an abstract concept that is difficult for teachers to describe

This study found that, when asked, teachers were not able to confidently articulate their perceptions of sustainability. Teachers responded with abstract associations of sustainability that were "far-reaching", "all-encompassing," or loosely tied with social change, environmental protection, or citizenship (McFarlane & Ogazon, 2011, p. 85). These responses reflect the general ambiguity that sustainability has when it is not specifically defined within a distinct context (Yanarella & Bartilow, 2000). Since teachers did not receive a formal education of sustainability or sustainability education, it is reasonable that their responses were vague and inconsistent with the academic definitions of sustainability. Had teachers been trained to understand sustainability and sustainability education, either in pre-service education or continuing education programs, it is expected that they would be more confident and specific in their definitions of sustainability and that they may have been able to recognize the "complex inter-connectedness" between social, economic, and environmental systems (Lozano, 2008, p. 1842). Although teachers expressed vague perceptions of sustainability when asked on the spot, when describing lessons they attributed to sustainability and sustainability education, teachers shed light on the fact that they have a deeper understanding of sustainability but they just are not able to concisely articulate it on command. The follow section elaborates on teachers' perceptions of sustainability.

Theme 3: Teachers frame SE in terms of the effects humans have on ecological system

The results of this research indicated that teachers recognized sustainability as a concept that addressed the relationships between human and ecological systems. Teachers highlighted the detrimental effects humans have on the environment and some

potential avenues for altering human behavior in order to be more ecologically sustainable. While problem-based frameworks (Nolet, 2009) and future thinking models (Jones et al., 2012) are excellent approaches for teaching SE, in order to be truly effective methods, teachers must incorporate the environmental, social, and economic factors associated with the sustainability issues. The lessons these teachers provided were embedded with the dimensions of sustainability; however, teachers solely focused on the environmental issues. Their environmental focus may have been due to the fact that the majority of the lessons were taught in the context of science education. Teacher's tendency to focus on environmental aspects of sustainability, especially when in the context of science, is consistent with existing literature on practicing teachers (Nasir et al., 2012). The teachers involved in this study could expand on their understanding and implementation of sustainability in the classroom (be it science, social studies, language arts, or math) with the assistance of professional development, curricular support, and institutional drivers (Stevenson, 2007; Redman; 2013b). The following section describes how some teachers involved in this study were able to address the interconnectedness of sustainability in their teaching on their own accord.

Theme 4: Teachers frame sustainability in terms of the interconnectedness between human and ecological systems

Two of the teachers involved in this study demonstrated that sustainability education involves the interconnectedness between human and ecological systems and that these lessons can be especially effective when combined with place-based, critical questioning, and participatory methods of teaching and learning (Burns, 2011). These teachers were able to facilitate a dialogue with their students on how social, economic,

and environmental aspects interact in the context of energy issues in their region. Teacher 4's lesson on hydraulic fracturing is an excellent example of how teachers can embody the Bertschy et al (2013) competence components for ESD. The dialogue facilitated by Teacher 4 was exemplary because it included participation from various stakeholders involved in the issue of hydraulic fracturing in the community and provided her students an opportunity to democratically make an informed decision about the issue. Indeed, it is these types of transformative education experiences that can inspire students to engage in issues that affect their communities and the planet (Wheeler, 2013). While it is impressive that Teacher 4 was able to provide this type of education opportunity for her students, this lesson was a unique example that took a lot of time, energy, and planning. The following section explores the feasibility of sustainability education for teachers in this study and compares the findings with the trends found in the literature review.

Feasibility of sustainability education

Theme 5: Teachers' ability to practice SE is informed by institutional drivers

Teachers in this study described how they felt constrained by the state standards and the associated standardized testing. These findings reflect the larger trends in the education system (Feinsten, 2009) and the research on teachers perceived abilities to teach SE (Metz et al., 2010). If sustainability were included in the teachers' standards, it would ensure that teachers were teaching sustainability. Since sustainability is not included in elementary science or social studies education, the teachers perceived sustainability to be an *add on* to their curriculum as opposed to an *avenue for* teaching their curriculum (Metz et al., 2010). None of the teachers in this study mentioned the possibility of sustainability shaping the entire culture and curriculum with which they

teach as is proposed by Nolet (2009). The teachers in this study expressed how "supplemental enrichment" provided space for SE as opposed to seeing sustainability education as the overarching framework for which they address their curriculum standards as advocated for by Sterling (2009). Other teachers questioned the place for SE in their curriculum in any form. Their reasoning is described in the following section.

Theme 6: Teachers question the appropriateness of SE for their students

Some of the teachers in this study perceived the content embedded in sustainability education to be value-laden and challenging for their students intellectually and emotionally. While teachers generally expressed a desire to teach some of the values of SE to their students, they were unsure of their students' abilities to understand the concepts. This finding is interesting in that some of the research on teachers hesitations to teaching sustainability indicated the opposite: that teachers wanted to teach the concepts but they did not want to teach the values (Quablan et al., 2011). There are examples of sustainability education being taught in primary education and even kindergarten (Davis & Elliot, 2014), which suggest that sustainability education can be appropriate and digestible for younger learners. Teachers also described how they felt that sustainability education might be too personally demanding of their students given that some of their students are struggling with poverty and family life. Thus, teachers perceived that their students might not be ready to take on the responsibility of creating a sustainable society. This notion fundamentally challenges the heart of sustainability education which is to prepare youth leaders for a more sustainable future (Sterling, 2009). The following section describes how innovative teaching methods can be used to teach SE.

Theme 7: Teachers' innovative teaching methods can provide the foundation for SE

The teachers in this study were passionate about providing transformative learning opportunities for their students and were incorporating innovative teaching methods into their curricula. Many of the lessons teachers described utilized place-based education (Sobel, 2005), experiential education (Qualters, 2010), nature-based education (Louv, 2005), and outdoor education (Sandell & Öhman, 2010) methods. The teachers exemplified the dimensions of the Burns Model of Sustainability Pedagogy (Burns, 2011); however, the content was not always focused on sustainability issues. With the assistance of continuing education programs and standards-based SE curricula, teachers in this study could likely meet the mark of SE (Redman, 2013b). The following section outlines how school resources and community partnerships can be assist teachers in teaching SE.

Theme 8: School resources and community partnership provide opportunities for teachers and SE

Most of the teachers involved in this study expressed interest in enhancing the resources at their schools. Teachers described how they would love to have access to greenhouses, vegetable gardens, butterfly gardens, bluebird trails, and compost piles to use with their students. Some of the teachers had either collaborated with or were currently interested in collaborating with community groups to aid in the instillation and maintenance of these resources or to provide curricula that could be used in accompaniment with these resources. These teachers recognized that they could not carry out these projects on their own due to the fact that they were "already over-committed

teachers" (Redman, 2013b, p. 19). Other teachers simply described how resources like these would be useful, without indicating a plan for development.

The teachers voiced that they were interested in expanding their partnerships so that they could provide even better educational opportunities for their students. The findings on this study are consistent with the research on the roles of communities in assisting with the facilitation of SE (Stevenson, 2007; Cole, 2010; Taylor et al., 2011).

Summary

The findings of this study indicated that there is space for sustainability education in Athens County elementary schools. While teachers may not be as informed about sustainability, they display a desire to provide transformative learning experiences for their students. The pedagogical model of SE reflects the style and quality of education that teachers wish to bring to their students. What is arguably holding teachers back from teaching SE is that they do not know that it exists nor do they realize how SE could assist them in teaching what they already need to teach. The following section presents recommendations for how SE could be integrated into the classroom.

Recommendations

Starting from here

Athens County, with its vibrant sense of place and established dedication to sustainability, is an exceptional starting point for the journey towards integrating sustainability education into the public school system. This section outlines how, through research and projects, sustainability education initiatives can be integrated into Athens County education systems.

Expanding on the present study

Given the nature of this case study, specifically that this study consisted of five individual interviews, there were limited options for assessing validity. The method of triangulation could not be utilized because there was only one method of data collection. The incorporation of classroom observations and document analysis of curriculum materials would have provided an opportunity for triangulation and therefore enhanced the depth, breadth, and richness of this study. Interviews with administrators and partnering community organizations could also provide additional context to this study.

Since teachers were only interviewed once for this study, this study was not able to include member checks. Both the study and the participants would have benefited from follow-up discussion on the emergent themes. For instance, this study noted that teachers might have never been directly asked to describe sustainability or SE before this study and that sustainability potentially was a concept that they had not given much thought to before. It is plausible that after participating in the interview for this study, teachers began thinking more about the role of sustainability and sustainability education, grappling with the issues embedded in these concepts, and assessing how SE could inform their roles as educators. These issues could not be addressed in this study due to the fact that this study was not able to include follow up interviews with teachers.

This study could be replicated with teachers from other grades, subjects, and schools to gain a deeper understanding of how the themes of this study take place across grades and disciplines in Athens County.

Teachers, administrators, and school districts

Research on forming collaborations between teachers, administrators, and school districts in the county could provide opportunities for curricular resource sharing and SE project developments. Funding for farm-school programs, renewable energy systems, and land labs would enhance the educational resources at schools and in the districts.

Pre-service teacher education, and continuing teacher education programs

Teacher education programs provide the foundation for future teachers of sustainability education. If teachers are learning, from the start, how to teach using the principles and practices of SE, this would enhance the presence of SE in the public school system. A longitudinal study on pre-service teachers and in-service teachers in Athens County on current SE practices and SE developments would provide insight into what aspects of SE already exists, how these initiatives could be improved, and how SE teacher education programs can be developed to meet the needs of the community.

Universities, non-profit organizations, community groups, and foundations

Non-profit organizations, universities, community groups, and foundations can assist in the integration of SE into the public education system and community education in Athens County. Research on K-12 academic standards and community resources could lead to a place-based, SE curriculum guide that is specific to Athens County. Part of this research could include a community-wide round table event where formal educators, informal educators, foundations, organizations, and businesses interested in SE could come together and develop a community-based sustainability education action plan.

Standards, curriculum, and policy

Research on education policy and teacher education programs could lead to ways of incorporating SE at the state and national levels. The revitalization of science and social studies to include more accurate representations of sustainability in the state and national standards would strengthen the quality of SE and make it mandatory for teachers to teach their students about sustainability. With the revised standards, teachers could also receive detailed curriculum guides for teaching integrated sustainability education. Ideally, these guides would also include a list of resources and potential community collaborations that teachers can utilize in their teaching. Exploring exemplary cases of SE policy, standards, and curriculum within and outside of the United States could provide insights into further development of sustainability education initiatives in Athens County.

Researcher Reflections

I came into this study with my own conceptions about sustainability, sustainability education, and the place of sustainability education in the public education system.

My understanding of sustainability is partly based on my formal academic studies in environmental studies and sociology however, my understanding of sustainability is largely informed by my personal drive to learn how sustainability exists in practice and how individually and collectively we can work towards creating an environmentally, socially, and economically just and sustainable world. Thus, I came into this study deeply devoted to sustainability as a concept and as an action plan.

My understanding of education and my vision for education is largely informed by my experiences with alternative education. I have been involved with alternative farm-

based homeschooling cooperatives as well as non-profit education organizations in my community education organizations, serving as both an educator and an organizer. I have experienced the spaciousness of alternative education models and the opportunities that are available when educating outside of the formal education system. In regards to sustainability education, the alternative educational initiatives I have witnessed and participated were fundamentally driven by the pedagogy that is reflected in models of sustainability education.

My understanding of the public education system is informed by my personal education experience within that system as well as the way I have learned about the public education system through news outlets and conversations with educators (mostly alternative educators). It is important to recognize that coming into this study I was skeptical of the space for sustainability education in the public education system given what I had learned about the standards, testing, and homogenized curriculum. However, after living in Athens County for five years, feeling deeply integrated into the community, and meeting some of the teachers and students that are involved in the public education system I knew that my critical conceptions about the public education system must be taken into consideration with other factors.

Over the course of this study I began to deeply respect the public education system and its teachers. I learned how teachers in my community were developing lessons for their students that, in many cases, were above and beyond any lessons that I had experienced in alternative education settings. These teachers were extremely knowledgeable about their subject matter, passionate about teaching, and qualified to teach. They were doing the best they could with the structures that were in place. These

teachers were reaching a larger and broader audience of students (i.e. 100 5th graders per year) and, therefore, had the ability to impact far more people that the small, subculture of students (i.e. the same 20 students every year) in the alternative education arena. This studied showed me how SE cannot merely exist in isolated, alternative education settings; it must be integrated into the public education system.

I came into this study with a personal commitment to playing a role in sustainability education. Over the course of this study I learned about the multiple factors that contribute to the presence of SE and the different actors that will be involved in the implementation of SE. There are many avenues to that need to be explored in order to see how SE can proliferate.

Summary and Conclusion

This qualitative case study explored the factors that influence the space for sustainability education in elementary science and social studies education. This research proposed that teachers are ultimately responsible for the presence of sustainability education in the classroom. The literature implied that the current structure of the education system, despite its limitation, presents the space for teachers to integrate sustainability education into their curriculum while still addressing the demands of the education institution. The teachers in this study expressed interested in teaching sustainability education and echoed the opportunities and challenges associated with SE that were found in the literature. In order to integrate sustainability education into the classroom, teachers need to learn about sustainability and sustainability education and, with the support of community and university partnerships, develop strategies for teaching sustainability education to their students. With an understanding of

sustainability and a desire for lifelong learning, graduates of the public education system

can be better prepared to address the pressing challenges of navigating towards an

environmentally, socially, and economically just and sustainable world.

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APPENDIX A: RECRUITMENT LETTER

Hello _____,

My name is Sarah Minkin and I am an Environmental Studies graduate student at Ohio University.

I am contacting you today because I am interested in recruiting Grade 5 science and social studies teachers for my graduate thesis research. For my research, I will be examining how teachers are approaching science and social studies standards and whether or not sustainability issues are being addressed in the curriculum.

I am requesting your involvement in my research study. Your involvement would consist of 1 interview (approximately one hour long). This interview can be conducted at your school.

If time allows, I would also be interested in observing a science and/or social studies class you teach. This would consist of me sitting in on the class and taking notes.

Please let me know if you would be able to participate in my research. I would be happy to answer any questions and address any concerns you may have.

Also, I would like to invite your students to the Ohio University gardens for a standards-based field trip. I consulted with teachers from East and West Elementary in the past and, with the assistance of my Environmental Education Interns, I designed and facilitated field trips. All of the 5th Grade classes came out to the gardens (we paid for transportation) for a 2-hour field trip. If you are interested in learning more about this opportunity, feel free to contact me. I understand that with all of the snow days we had this spring, field trips may not be feasible at this time.

Thank you for your time,

Sarah Minkin
740-591-1246

APPENDIX B: CONSENT DOCUMENT

Ohio University Consent Form

Title of Research: An exploration of teaching methods used by Grade 5 science and
social studies teachers.
Researcher: Sarah Minkin, Ohio University Graduate Student

You are being asked to participate in research. For you to be able to decide whether you
want to participate in this project, you should understand what the project is about, as
well as the possible risks and benefits in order to make an informed decision. This
process is known as informed consent. This form describes the purpose, procedures,
possible benefits, and risks. It also explains how your personal information will be used
and protected. Once you have read this form and your questions about the study are
answered, you will be asked to sign it. This will allow your participation in this study.
You should receive a copy of this document to take with you.

Explanation of Study

This study is designed to explore how science and social studies issues are being
taught in Athens County. I am interested in learning about the strategies and methods
teachers use to teach these subjects. I am particularly interested in the topic of
sustainability and I am to see whether or not teachers are addressing aspects of
sustainability in their classroom.

If you agree to participate, you will be asked to be available for one interview and
two classroom observations. The interview will last approximately one hour and will take
place at your school at a time that is convenient for you. I will be asking you questions
about your teaching strategies and beliefs. These interviews will be audio recorded.

After this initial interview, we will arrange times for me to come and observe your
class. Ideally, I would like to observe at least one social studies lesson and one science
lesson. During these observations, I will be quietly sitting or walking around in the
classroom, taking notes and taking photographs.

You should not participate in this study if you are not interested. Your participation in
the study will consist of approximately three sessions that are at about 1 hour long. I may
contact you by email after these sessions if I have any questions or need for clarification.
Your participation in this study will end by April 2014.

Risks and Discomforts

No risks or discomforts are anticipated as a result of participating in this study.

Benefits

This study is important to science/society because it provides and insight into how
youth are learning. There is not an immense amount of research on this topic,
especially research involving interviews with teachers.

Individually, you may benefit from this study by learning about how other teachers are approaching Grade 5 science and social studies standards.

Confidentiality and Records

Your study information will be kept confidential by removing your name from research materials. Instead, a pseudonym will be used. You will have the option to withhold photographs of yourself from research publication material.

Additionally, while every effort will be made to keep your study-related information confidential, there may be circumstances where this information must be shared with:
* Federal agencies, for example the Office of Human Research Protections, whose responsibility is to protect human subjects in research;
* Representatives of Ohio University (OU), including the Institutional Review Board, a committee that oversees the research at OU;

Contact Information

If you have any questions regarding this study, please contact Sarah Minkin [sm318208@ohio.edu; (740) 591-1246.

If you have any questions regarding your rights as a research participant, please contact Jo Ellen Sherow, Director of Research Compliance, Ohio University, (740) 593-0664.

By signing below, you are agreeing that:
- you have read this consent form (or it has been read to you) and have been given the opportunity to ask questions and have them answered
- you have been informed of potential risks and they have been explained to your satisfaction.
- you understand Ohio University has no funds set aside for any injuries you might receive as a result of participating in this study
- you are 18 years of age or older
- your participation in this research is completely voluntary
- you may leave the study at any time. If you decide to stop participating in the study, there will be no penalty to you and you will not lose any benefits to which you are otherwise entitled.

Signature_____ Date_____

Printed Name_____

Version Date: *[insert 01/13/90]*

APPENDIX C: IRB APPROVAL

OHIO
UNIVERSITY
Office of the Vice President for Research

14X013

Office of Research Compliance
RTEC 117
Athens, OH 45701-2979

T: 740.593.0664
F: 740.593.9838
www.research.ohiou.edu

The following research study has been approved by the Institutional Review Board at Ohio University for the period listed below. This review was conducted through an expedited review procedure as defined in the federal regulations as Category(ies):

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Project Title: Teaching for Change: An Examination of Sustainability Education in Athens County Elementary Schools

Primary Investigator: Sarah Michelle Minkin

Co-Investigator(s):

Faculty Advisor: Nancy Manring
(if applicable)

Department: Environmental Studies

Robin Stack

Robin Stack, CIP, Human Subjects Research Coordinator
Office of Research Compliance

Feb. 27, 2014
Approval Date

Feb. 26, 2015
Expiration Date

This approval is valid until expiration date listed above. If you wish to continue beyond expiration date, you must submit a periodic review application and obtain approval prior to continuation.

Adverse events must be reported to the IRB promptly, within 5 working days of the occurrence.

The approval remains in effect provided the study is conducted exactly as described in your application for review. Any additions or modifications to the project must be approved by the IRB (as an amendment) prior to implementation.

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APPENDIX D: INTERVIEW GUIDE

<u>Background Questions:</u>

-How long have you been teaching?
-Why did you choose to become a teacher?
-What are some of your favorite subjects/lessons?

<u>Curricular Questions:</u>

-What kinds of materials do you use to develop your lessons?
-How often do you develop new lessons?
-Are there particular subject criteria you enjoy teaching?
-Are there particular subject criteria (standards) you have difficulty with?
-What kinds of lessons do you do for [insert standard]?

<u>Sustainability: Understanding:</u>

-When I say the word "sustainability" what comes to mind?
-Have you heard this term used? What contexts? (Prompts: community, work)
- Do you remember where you first learned about sustainability?

<u>Sustainability: Perceptions:</u>

-Do you have an opinion about sustainability? (Prompts: Do you think that sustainability initiatives [name examples] are important? Do you feel impacted by sustainability?
-Do you think it is important to teach students about sustainability?

<u>Sustainability: Implementation:</u>

-Do you think you teach your students about sustainability? Why or why not?
-What motivated you to incorporate sustainability into your curriculum?
-What aspects of sustainability are teachers teaching (i.e. environmental, social, economic)?
-When did you start to incorporate it?
-How do you incorporate these themes into your lesson plans?
-What are some of the benefits/obstacles for teaching sustainability?
-Do you intend to continue incorporating sustainability themes into your curriculum this year and in the future? Why or why not?

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