ABSTRACT

BARRETT, MICHAEL. An Investigation of the Effectiveness of Garden Based Learning for Elementary School Students with Disabilities Who Are Included in the General Curriculum. (Under the direction of Drs. Susan Osborne and Ed Sabornie).

Students with disabilities (SWD) have struggled in regular classrooms for decades. Much research has been done regarding the effects of Garden Based Learning (GBL) on students without disabilities over the last 20 years (Blair, 2009; Ozer, 2007; Williams & Dixon, 2013). While most of that research showed positive effects, SWD were rarely included in those studies. This study used qualitative data gathered via interviews, observations, and surveys at an elementary school that utilized GBL to describe the experience of SWD in a school garden (SG). This study's main purpose is to narrow the gap in the literature concerning SWD and SGs and provide a basis for further research. This study examined how SWD functioned in a GBL setting and documented the benefits and concerns associated with that setting. Findings agreed with the literature for students without disabilities regarding access to the science curriculum and GBL being an active, positive experience for SWD with beneficial outcomes beyond the academic. Finally, this study includes recommendations for future research and implications for practice.

Keywords: school gardens, garden based learning, students with disabilities, experiential education, public schools, qualitative, pragmatism

An Investigation of the Effectiveness of Garden Based Learning for Elementary School Students with Disabilities Who Are Included in the General Curriculum

by
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BIOGRAPHY

I did most of my growing up as a displaced Yankee in Fayetteville, NC. I graduated from high school there and then spent one year at Western Carolina University. I transferred to NC State and in 1987 I graduated with a degree in Aerospace Engineering. About a decade later I made a career change and began teaching in Japan. I came back to the US, and I realized that I wanted to continue teaching. As a laterally certified teacher I enrolled at NC State in a Master's Program for Special Education.

A few years later I switched from being a math teacher to an EC Inclusion teacher at Person High School in Person County, North Carolina. I have since worked similar jobs in Chapel Hill and Orange County, NC.

Several years into my time at Person High School, I once again started taking classes at NC State, this time for my PhD. While working on the PhD I taught as adjunct faculty at NC State and really liked it. Now, having completed my PhD, I am looking forward to teaching at the university level.

ACKNOWLEDGEMENTS

First a huge thank you to my committee - thank you Susan Osborne, Ed Sabornie, Val Faulkner, and Wendy Warner for sticking with me over these nine-plus years. I could not have done this without your guidance and support. Susan Osborne especially has gone above and beyond the call of duty to support, guide, and mentor me for nearly 20 years. Her generously offered wisdom has been invaluable. Another member of the N.C. State family needs to be mentioned. Irene Armstrong has been helping students for many, many years, and I know she has solved a lot of problems for me over the years. Thank you Irene.

I also want to thank the principals, teachers and students of “Oakdale” Elementary school. Your wonderful garden served as the inspiration for this document, and I could not have done this without you.

I must recognize the loving support of my wife Marci Zampi. She provided the spark that actually got me working on this PhD, and her help was an instrumental part of me getting this project completed. I love you and look forward to spending the rest of our lives together.

But this journey did not start 10 or even 20 years ago. This road began in 1974; the year my father had a heart attack. He was working on his dissertation, and though the heart attack did not immediately kill him, he died before he could finish his PhD. My mother passed away just a few years ago. She, of course, knew I was working on my PhD, but she did not live to see me finish my dissertation.

My parents Robert J. Barrett and Mary Jane Barrett may be gone, but they have always been, and always will be, an inspiration to me. I like to think they would be proud.

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Research Problem

Compared to their typical peers, SWD perform lower on standardized tests, drop out at a higher rate and struggle academically to meet the expectations of general education classrooms. The National Assessment of Educational Performance (2017) fourth grade reading and math scores showed that SWD performed below their typical peers. In reading SWD scored 214 versus 243 for typical students, and in math SWD scored 187 versus 227 for typical students. Dropout rates are more than twice as high for SWD (11.7%) as compared to non-SWD students (4.9%) (National Center for Educational Statistics, 2019). In North Carolina, standardized testing has also showed that SWD have been underperforming as compared to their non-SWD peers. The 2019-2020 standardized tests for third through eighth grade showed that 76.9% of SWD were not proficient. On those same tests, 34.1% of typical students were deemed not proficient (North Carolina Department of Public Instruction, 2020). While a myriad of factors may have influenced those outcomes, the above statistics demonstrate that SWD do not function academically as well as their typical peers in a regular classroom setting.

Experiential education has been shown to improve typical students' academics and traits supportive to academics such as responsibility, resiliency, motivation and problem solving (Beightol et al., 2012; Hattie et al., 1997; Robinson, 2013). Getting students out of the regular classroom engages their senses, allows for novel, more memorable experiences, allows for contact with nature and breaks the monotony of the regular educational setting. One type of experiential learning program, garden based learning, has shown promise for typical students to improve their academic and non-academic outcomes (Ozer, 2007; Blair, 2009; Ohly et al., 2016; Williams & Dixon, 2013). Gaining a better understanding of how GBL programs affect SWD has the potential to give educators another tool to use in closing the SWD, non-SWD achievement gap.

Purpose/Significance

This study focused on elementary aged students with disabilities and utilized qualitative data to investigate how elementary SWD experience garden based learning. By gathering and analyzing various forms of qualitative data, this single case study investigated whether a school garden could allow SWD to access the academic curriculum (defined herein as the *opportunity* to engage with specified learning goals) and explored the positive and negative impacts that might come from the use of a well-maintained SG. SGs have been shown to help students without disabilities perform academically, particularly in science and math, and to increase nutritional knowledge, to make better dietetic choices, to improve behavior, and to feel more connected to school and their communities (Blair, 2009; Christian et al., 2013; National Foundation for Educational Research, 2010; Ohly et al., 2016; Parmer et al., 2009; Williams & Dixon, 2013).

Standards adopted by most states now call for all students to be either workplace or college ready upon completion of their K-12 education. This preparation begins in elementary school and lays the foundation for academic success for both typical students and SWD who participate in the general educational curriculum. Recent educational initiatives such as Common Core have brought an emphasis to using real world examples and authentic experiences in education; GBL is a way to bring such initiatives to life.

The Common Core State Standards (CCSS) are currently being used in over 40 states, with nearly all states moving to adopt standards in mathematics and language arts that emphasize a deeper conceptual understanding of curricular topics through higher ordered thinking rather than employing curricula that rely more on memorization and procedures. The CCSS are the result of an effort started in the middle of the previous decade by governors, state superintendents, and other educational advisers to develop national learning standards that would lead to more consistency in instruction and assessment of learning across the various states (National Governors Association Center for Best Practices & Council of Chief State School Officers, 2016). In teaching students a deeper understanding of math, science, and language arts, good teachers make use of hands-on problem solving related to real life experiences. SGs allow students of all grade levels and abilities to build numerical, scientific, social, and health related skills in a real life setting, engage in critical thinking, and collaborate on data driven projects that give context to their calculations (Blair, 2009; Mabie & Baker, 1996; Williams & Dixon, 2013). GBL has been cited in numerous studies as having a strong health and nutrition component. Students can grow, touch, and taste fruits and vegetables which improves their eating choices, raises their activity levels and so promotes a healthier lifestyle. (Christian et al., 2013; Grow et al., 2010; Ozer, 2007). Of particular academic relevance is the opportunity SGs offer students to explore quantitative concepts, develop higher ordered thinking skills, and solve problems as part of the CCSS and similar standards adopted by other states.

GBL has the potential to make many of the concepts and ideas embodied within the current elementary curriculum more concrete and meaningful for students who struggle in the tradition classroom. GBL provides a way to provide access to school curricula through hands-on, real world experiences and problem solving for students of all abilities (Estes, 2004; Rye et al., 2012).

Research involving SGs has been increasing over the last two decades. Ozer's review of the literature included five studies (2007). Blair's more comprehensive literature survey included 19 studies (2009), and Williams and Dixon review of the literature examined 48 studies (2013).

California's 100% SG initiative that began in 1995 helped contribute to this growing body of research (Hazzard et al., 2011). While Ozer, Blair and Williams and Dixon reviewed dozens of studies, none of them reported data concerning SWD.

Some studies have been conducted that included SWD. Generally they have shown promising effects for academics, nutritional knowledge, self-confidence, self-efficacy, social, and behavioral concerns (Hussein, 2012; Passy et al., 2010; Rye et al., 2012; Smith and Aldous, 1994, as cited in Bowker & Tearle, 2007). Hussein's study focused on students with more profound disabilities who did not participate in the regular curriculum. A report of research sponsored by the Royal Horticultural Society (RHS) included data that supported GBL for SWD in the areas of science, math, and literacy (Passy et al., 2010).

Research that pertains to the functioning of SWD included in the general educational curriculum and who participate in SG program constitutes a very small part of the research done on SGs. This study attempted to close that gap in the literature by contributing a body of qualitative data to describe and evaluate how participation in garden based activities can enhance SWD access to the general curriculum. Other positive and negative effects of a GBL program were also investigated.

List of Abbreviations

- **504** – A section of the Vocational Rehabilitation Act of 1973 that allows students to receive assistance in school if they have a life-limiting condition.
- **CCSS** – Common Core State Standards
- **CRA** - concrete-representational-abstract
- **GBL** – Garden Based Learning
- **IDEA** – Individuals with Disabilities Education Act

- **IEP** – Individual Education Program (for students with an identified disability)
- **NFER** - National Foundation for Educational Research
- **SG** – School garden
- **SWD** – Students with Disabilities – students who have an IEP or 504 plan
- **RHS** – Royal Horticultural Society

Participating School

The participating school of this single case qualitative study was an elementary school located in the Southeastern United States. The school, Oakdale Elementary (pseudonym) was located in a suburban setting not far from a major population center and had a functioning SG for more than five years which was used to support academics concerning science, math, health, nutrition, language arts, and art. Also, Oakdale was a year round school which allowed them to maintain and use their garden in the summer and throughout the growing season.

I conducted a qualitative pilot study that showed the garden to be well-utilized and an effective support for general education students in accessing the standard science curriculum (Barrett, 2013). Further details concerning the school and the study's participants are presented in chapter three.

Research Question

This research investigated the effects of GBL for SWD qualitatively through surveys, interviews, and observations of SWD at one elementary school with a SG that was used to support students in accessing the general curriculum. Patton (2002) stated that "Understanding what people value and the meanings they attach to experiences …" (p. 147) are worthwhile topics for qualitative inquiry. Qualitative research is often initially described via an initial broad research question with more specific sub-questions that dig deeper into the subject (Creswell, 2013). For this study the main research question was *how do SWD experience learning in a SG?* This question facilitated the investigation of how SWD experience a SG and the impacts SGs may have on students' school experiences. In chapter three sub-questions will be presented which will allow detailed aspects of the main question to be investigated (Creswell, 2013).

School Gardens - Background

SGs have the potential to provide many positive experiences for students, including better academic outcomes, increasing self-efficacy and independence, improving nutritional awareness, and developing patience, teamwork, and a sense of community (Blair, 2009; National Foundation for Educational Research, 2010; Ozer, 2007). Educators as far back as John Dewey have used gardens to enhance the educational experience for their students (Ralston, 2011). Maria Montessori was an advocate for experiential education and the hands-on approach to learning that SGs employ (Fisher, 1964). More recently, research has shown that the use of practical, everyday situations can aid in students' understanding of math and science concepts, and that placing students in new situations can spur growth in problem solving skills (Mercer & Miller, 1992). The popularity and use of SGs has waxed and waned over the last 100 years with their utilization now increasing in tandem with the slow food, buy local, and organic food movements. Also the increased value people now put on knowing how their food is grown and in making better dietetic choices has increased the popularity of gardens (Conner et al., 2009).

The value of experiential learning was recognized by John Dewey early in the previous century. He held that education could best be implemented by building on a foundation of personal experience from observing and interacting with the phenomena of interest (Dewey 1916, 1938; Langhout et al., 2002). Piaget (1961) stated that physical experience is necessary to the development of a child, and dynamic aspects of experience that deal with transformations help humans understand the world around us. A student in a garden is experiencing transformations, causes with effects, and receives information on their changing environment which stimulates interest and learning (National Foundation for Educational Research, 2010). Building on the theories of Dewey (1938), Piaget (1961), and Freire (1970), Kolb and Kolb stated that “Learning results from synergistic transactions between the person and the environment” (2005, p. 194). Surveys of the literature on experiential learning theory have shown support for experiential learning across many fields including education (Kolb & Kolb, 2005). Drawing on the work of Dewey (1938), Kolb (1984), and Lewin (1946), Mitchell and Poutiatine (2001) referred to experiential education as “a purposeful inquiry emphasizing an iterative process of doing, observing, thinking, and reflecting.” (p.2).

Growing interest in exploring the effects of participation in GBL is reflected in surveys of the literature. When she searched for peer reviewed literature concerning SGs in July 2005, Ozer found five studies that met her criteria for inclusion in her review (Ozer, 2007); in 2009, Blair found 19 studies worthy of review while a more recent survey of the literature by Williams and Dixon (2013) surveyed 48 peer reviewed studies pertaining to SGs published between 1990 and 2010. In the last 20 years, researchers have shown more interest in SGs as a worthwhile subject for study as concerns over obesity and health have intersected with growing interest in offering children outdoor spaces to play and experience nature (Williams & Dixon, 2013).

SGs provide opportunities for students to experience hands-on learning that reinforces their academic learning. Also, in a garden students can move, touch, taste, dig, plant, harvest, and become responsible for caring for a part of their environment. This experience allows students of all abilities, including SWD, to access school curricula and to find intellectually stimulating opportunities outside of teacher directed lecture and seat work (Blair, 2009; Rye et al., 2012; Williams & Dixon, 2013).

Common Core and SWD

As the CCSS are used in over 40 states, some mention of how these standards impact SWD is in order. The CCSS themselves contain no references to SWD or appropriate academic performance standards despite the fact that over 60% of SWD spend at least 80% of their school day in general education settings (United States Department of Education, 2016). The CCSS website contained a single two-page document that merely restated the purpose of IDEA concerning SWD and their Individual Education Programs (IEPs). Furthermore, the document stated that the related services, adaptive technologies, accommodations, and modifications in the IEP's should be employed by school personnel to improve SWD access to the CCSS (Graham & Harris, 2013). CCSS offered no new or improved support for SWD beyond what already existed.

SWD tend to perform better on tasks that have a real world aspect to them. The more concrete a task is the better a student with cognitive or attention issues can understand an academic concept and make real meaning out of it (Estes, 2004). This teaching strategy connects well with the concrete-representational-abstract (CRA) approach to instruction, particularly in math, as concrete experiences can then be represented on paper and finally converted to an abstract idea depicted with numbers and symbols (Mudaly & Naidoo, 2015). The CRA instructional method has been shown to be effective for SWD (Bouck et al., 2017). A GBL environment connects well with the CRA method as gardens provide a wealth of concrete experiences for students of all abilities to build their learning (Estes, 2004). This connects well with "applying mathematics to practical situations" as stated in the CCSS for Mathematical Practice (National Governors Association Center for Best Practices & Council of Chief State

School Officers, 2016). Indeed, concrete experience is one of the cornerstones of Kolb's model for experiential education (Kolb, 1984) that will be discussed in the next chapter.

As suggested above, gardening is a real world activity that can make abstract math concepts, science texts, and writing prompts concrete. Data can be collected and charted; statistics can be generated and analyzed, and plant growth recorded and graphed. Measurements can be taken of plants as they grow; seeds counted and measured, and harvested produce weighed. Likewise, students can see, touch, and taste items grown in a SG and so be inspired to write more meaningful and more descriptive compositions based on their garden experiences. They can present their findings in technology-supported presentations concerning garden data with graphs and statistics appropriately represented and listen to and critique their peers doing the same (Blair, 2009; Bucklin-Sporer & Pringle, 2010, Ozer, 2007).

Chapter Summary

SGs are being investigated with more frequency across the country and around the world for good reason. The history of experiential education shows that for decades educators have seen value in the pragmatic way GBL gets students more involved in their learning. GBL programs fit well with the CCSS with their emphasis on math, language arts, science, critical thinking, and hands-on, authentic learning (Barrett, 2016). As will be shown in Chapter 2, the research literature demonstrates that GBL in particular and exposure to nature in general have definite academic, social, physical, and behavioral benefits for today's students, although research specifically inclusive of SWD is rare.

Chapter 2: Literature Review

A review of the literature concerning SG is warranted to place this study in the proper context within the research that has been conducted to date. In this section I discuss the history of SG and how Kolb's Model of Experiential Education built on the descriptions of learning developed by the pragmatists of the twentieth century. Specifically, the body of research pertaining to SGs has been organized according to the four stages of Kolb's model. Lastly, I have evaluated the research on SGs and their impact on SWD.

Historical Context for GBL

Gardens have been used in an educational context for over 100 years. Trelstad (1997) wrote about a small town in Massachusetts in 1891 that had a school with a garden. Subramaniam (2002), in discussing the same school, added that educator Henry Lincoln Clapp went to Europe in 1891 to learn about SGs which had been in use in Germany since the early 19th century. Upon his return, Clapp developed the first SG in the United States at the George Putnam School in Roxbury, Massachusetts. This impetus to return to nature was part of the Nature-Study Movement of the late 19th century. This movement built on the ideas of Rousseau and Froebel and emphasized countering the growing urbanization of the country by bringing nature-based learning to inner-city schools. This boom in school based gardens lasted through World War One (Trelstad, 1997). In the early 20th century an article in *Nature* included several positive effects of the "educational value of the school garden" (Nature Publishing Group, 1910). Some of the positive effects stated included that gardening develops patience, persistence, and an understanding of soil and climate; it produces tangible results, and, through experimentation, fosters creativity as students develop solutions to problems that arise in their SGs. John Dewey, pioneer of pragmatic educational reform, made sure that his Laboratory School at the University of Chicago had a garden. Ralston (2011) described Dewey's work with SGs, reporting that in

Dewey’s school’s garden his students “learned about mathematics, natural history, food science, and economic principles by both gardening and cooking the produce of the garden” (p. 6). Dewey has been identified in many articles as providing the philosophical foundation to the experiential education movement. Dewey (1916) advocated for SGs:

> Where schools are equipped with gardens…opportunities exist for reproducing situations of life, and for acquiring and applying information…Gardening need not be taught either for the sake of preparing future gardeners, or as an agreeable way of passing time…[gardens] are a means for making a study of the facts of growth, the chemistry of soil, the role of light, air, moisture (p. 235).

Dewey’s 1938 book *Education and Experience* has been identified by many scholars as describing the beginnings of experiential education (Estes 2004; Ord & Leather, 2011; Roberts 2008; Shyman, 2009). Indeed, Alison Kadlec (2006) referred to “Dewey’s democratic commitments to the transformatory potential of lived experience” (p. 519). Going from the past to the present, the current Common Core Standards make mention of “applications”, “hands-on”, and “applying mathematics to novel situations” and “everyday life” (National Governors Association Center for Best Practices & Council of Chief State School Officers, 2016).

Maria Montessori also saw the educational value in living an experience. She thought that SGs could help children in their moral development and could increase their appreciation of nature. Through using the senses to stimulate the intellect, she saw that helping plants grow helped children develop an appreciation of nature and enhanced their moral development (Subramaniam, 2002).

The World Wars were a catalyst for gardens to gain in importance and popularity as civilians sought to support the war effort. The School Garden Army was created during the First

World War with federal funding to encourage children to learn to grow food locally so as to improve the quality of the national food supply during the war years. Millions of school children participated in the program, though it was halted due to post-war funding cuts enacted in 1920. As a result many SGs were abandoned in the early 1920s (Trelstad, 1997). It took another world war to bring renewed educational emphasis to SGs. Schools in the cities during World War Two instructed their students in hands-on gardening so that they could create Victory Gardens at home with their families. Elzey (1944) described a school-to-home gardening project in a suburb of Detroit. The elementary and middle school students started with general experiments to show the importance of light, water, and soil composition. They then planned and developed a SG which led to the students constructing gardens of their own at home. Parents cooperated well with the school and helped their children grow substantial amounts of vegetables which were displayed, eaten, and preserved the following fall. Thus students were encouraged to help their families grow vegetables at home in Victory Gardens at a time when food was rationed, and fresh food was in short supply (Elzey, 1944).

In the years following World War Two, SGs were used less frequently as educators shifted their focus towards math and science in the 1950s in response to the growing technological threat of the Soviet Union. Gardens had a revival in the 1960s into the 1970s due to the birth of the environmental movement and as an offshoot of the war on poverty. During that time SGs were conceived as a progressive, interactive, educational tool for helping children understand their environment. However, the return to political conservatism in the 1980s caused interest in SG to fade again, but with renewed interest in organic food, growing food locally, and giving children real-life connections to school curricula, SGs have seen their popularity grow since the 1990s (Subramaniam, 2002).

Also in the 1960s, educational theorists began questioning the lecture and rote memorization that was common in American schools after World War Two. Paolo Freire (1970), a vocal advocate for critical pedagogy in the late 20th century, decried the "banking" idea of schools in which students are passive receptacles of knowledge into which teachers deposit information and then withdraw it when it is time for a test. According to Freire this creates a schism between the student and the real world. This separation of the student from the real world that concerned Freire in the 1960s has been duplicated and even exacerbated with the current focus on tests and testing. The desire for higher test scores has meant that outdoor time and physical activity have been reduced in many schools (Committee on Physical Activity and Physical Education in the School Environment et al., 2013) causing students to be even further removed from real world experience than they were in the 1960s and 1970s when Freire was observing and writing.

Theoretical Framework - Pragmatism

Pragmatism is defined by Creswell (2013) as having "a concern with applications", "what works", and "solutions to problems" (p.28). Other tenets of this pragmatic framework allow researchers to assume flexibility in choosing their research methods as pragmatism rejects the "either or" dualism that can dominate discussions in the social sciences which can reduce them to simplistic explanations that inhibit a deeper understanding of ideas, experiences, and processes (Teddlie & Tashakkori, 2009). With pragmatism's focus on practical consequences, pragmatists believe that meaning is found in the value of an action or experience (Johnson & Onwuegbuzi, 2004). As applied to education, learning and the nature of knowledge, pragmatism was embraced by one of education's principle pioneers.

John Dewey has been described as having a pragmatic view of education and learning (Roberts, 2008; Dixon, 2019). That is not surprising given that he was interested in such things as SGs (Ralston, 2011), learning through shared experience (Dixon, 2019) and practical experimentation (Miettinen, 2006). Kaushik and Walsh (2019) add that pragmatism holds that meaning is found in consequences, knowledge is based on experience and that shared experiences lead to shared beliefs.

Specifically, for Deweyan pragmatists, learning begins in experiencing novel and potentially uncomfortable situations with subsequent reflection generating new ideas that either blend into or replace previous knowledge. That new knowledge may expose weaknesses in previously held beliefs or be incorporated into new schema, but either way the new knowledge should be productive and useful (Maddux & Donnett, 2015). An aspect of Dewey's perspective on pragmatism involves him seeing communication as a precursor to consciousness or knowledge (Biesta, 2010). In education, this takes the form of collective reflection as students and teachers communicate their views of a previously shared experience. It is this reflection that seeks to resolve any issues or conflicts brought forth by the shared experience into new knowledge (Maddux & Donnett, 2015). Reflective communication, therefore, is a key component in creating knowledge from experience.

This study included interviews and surveys as tools to obtain the reflections of students and teachers who have experienced their school garden. To guide this discussion, research questions were developed which encourage the study's participants to reflect on their garden experiences so as to shed light on how SWD experienced the SG at Oakdale Elementary School. The bulk of the data gathered consists of the reflections of the study's participants with additional observations conducted by the author to confirm or refute the participants' statements.

Furthermore, Creswell (2013) informed us that pragmatism is an appropriate philosophical framework for research involving the practical aspects of education. One practical aspect of education that needs attention is hope. As it is my desire to find a source of hope in GBL, a hope that as many people as possible may find long term benefits in experiencing a SG, it is useful to have a hopeful philosophy underpinning the research. Pragmatism is hopeful as Koopman stated, “pragmatism [is] a philosophical way of taking hope seriously” (2006, p. 106). Teachers and students both need hope in these days of educational stress; SWD especially need hope as they struggle academically and socially. It is my hope that this study will show that their struggles in school may be mitigated to a degree by their contact with nature as they experience Oakdale’s SG.

Aiken stated that “Dewey holds that human life is bound up in the processes of nature” (2006, p. 319), supporting the idea that education and gardens fit together in a pragmatic sense. One of the goals of this research is to show that gardens are a rich source of experiences for SWD. These experiences begin the pragmatic cycle of learning that subsequently include generating new ideas via reflection, analyzing those new ideas and then testing the new knowledge out in the real world (Maddux & Donnett, 2015). Kolb built on the work of previous pragmatists and formalized that process in his model of experiential learning.

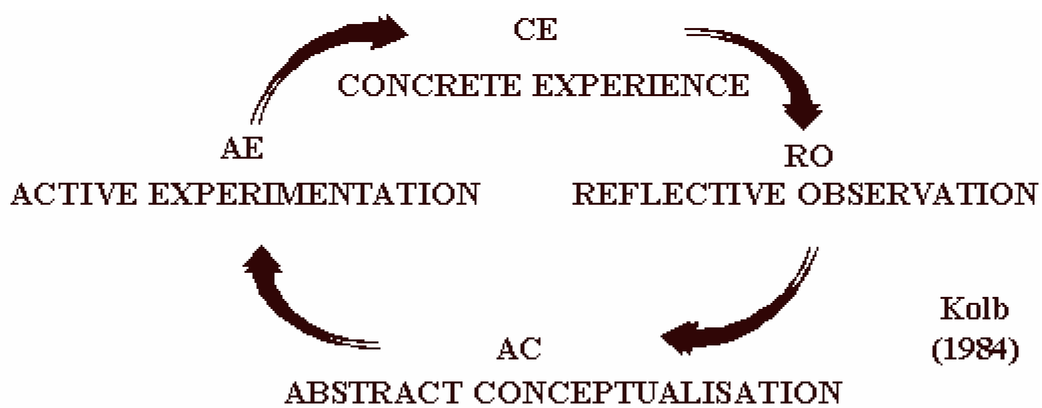
Kolb’s Model of Experiential Learning

Building on the work of Dewey (1938), Lewin (1946), and Piaget (1961), Kolb (1984) developed a definition of learning that features personal experience as its primary focus. According to Kolb, “Learning is the process whereby knowledge is created through the transformation of experience” (p.38). Indeed, for Kolb as it was for Dewey and the other pragmatists, it is experience that begins the process of learning. For Kolb, subsequent stages in the learning process involved reflection/observation, abstract/conceptualization, and active/experimentation, which can be summarized as the “what happened?”, “why is it important?", and the "now what?" steps that follow the initial action or experience (Figure 2.1). This process is then repeated in an iterative fashion allowing knowledge and experience to shape and build on each other (Kolb, 1984).

According to Kolb, concrete experience both begins the cycle of learning and reinforces learning through subsequent iterations. SGs provide a multisensory environment that allows students to experience the garden via all five senses. The colors and textures of the plants and their flowers, the taste of the various fruits and vegetables, the smell and feel of the freshly turned earth, and the buzzing of the pollinators all contribute to the garden experience. This wealth of sensory input gives SWD a variety of experiences that provide the foundation for the reflective, abstract and experimental learning experiences to follow.

Figure 2.1

Kolb's Model for Experiential Education (Kolb, 1984)



Experiential education can improve higher ordered thinking skills (Ives & Obenchain, 2006) and in general has been found to have many positive effects for students. These positive effects include greater engagement in learning (Robinson, 2013), increased resilience (Beightol et al., 2012), as well as improvements in self-efficacy, internal locus of control, and academics, particularly in problem solving (Hattie et al., 1997).

Immediate, concrete experiences form “the basis for observation and reflection” (Kolb, 1984, p. 21), and gardens have the capacity to provide a wealth of experience for students that involve the senses – from feeling the rich soil, smelling the flowers, to seeing the vibrant colors of the produce, to finally tasting the fruits of their labor. Reflection follows as teachers encourage their students to think and report on their garden experiences. Reflection proceeds to abstract conceptualization when students are asked “why is [this aspect] of the garden important?”, and active experimentation is developed by asking students to develop a concrete response to “now what can you do with your garden knowledge?” This framework supports further detailed investigations with quantity, measurement, gathering, recording, and reporting data and then using those data to support decisions concerning future garden activities. The literature on gardens will be presented in the following sections using Kolb’s model as a framework.

Concrete Experience

The first stage of Kolb’s cycle involves students having the real, hands-on experience of being in a SG. There have been many empirical studies which have surveyed the use of SGs or recorded data concerning students in gardens. Studies have been done which involve state wide garden programs, specific garden programs and involves a research literature that has recorded thousands of students and their GBL experiences.

California developed a statewide SG initiative in 2002. In 2005, Graham et al. surveyed 9,805 school principals in California, getting 4,194 responses. Of those responses, 2,381 principals reported having a SG, and of that number 85% of the respondents reported that their school used the garden for academic purposes. Science was the most commonly studied subject in the garden (95%), with nutrition (66%) and math (59%) also frequently studied.

In 1997, the University of Florida held a SG competition. Thirty-five schools with 71 teachers attended the competition. The authors did not report on how the schools were chosen or offer any reason as to why those schools entered the competition. The authors used the opportunity to conduct a research study into the benefits of SGs. Participating teachers (N = 71) were given an anonymous questionnaire to complete that consisted of 18 closed ended and partially closed ended questions (questions with specific categories of choices with an option for an uncategorized response). Demographic data on the teachers were not obtained. The results showed that 72.9% of the teachers regarded the SG as an experiential learning opportunity, and 84.3% reported that using a SG helped students learn. Garden use was low with 67.6% of teachers reporting that their students spent at most 1 hour per week in the garden. Also, approximately 60% of teachers reported that the garden was in use 10% or less of the available time. Garden use was reportedly limited by teachers not being trained on how to incorporate a garden into existing curricula and limited resources concerning expense and time (Skelly & Bradley, 2000).

Formal programs have promoted and evaluated SGs. A study done in Texas by Smith and Motsenbacker (2005) used the Junior Master Gardener Program which was developed at Texas A&M University. Asigbee et al. (2019) investigated the Texas Sprouts garden intervention with a subset of fourth graders at one elementary school to determine the program's impact on the students' physical activity. In the United Kingdom, the RHS supported the Campaign for School Gardening which began in 2007. The RHS commissioned the National Foundation for Educational Research (NFER) to determine the impact of school gardening on students' learning and behavior. NFER conducted a qualitative analysis from a representative sample of 10 schools that participated in the Campaign. An initial review of the RHS dataset on schools with gardens showed 6,235 verifiable unique cases of schools with gardens.

In addition to the research described above, there have been several reviews of the literature that have provided summaries of research on SGs. Williams and Dixon (2013) found 48 studies that put students in school gardens. Blair (2009) reviewed 19 studies of students using school gardens. In 2007, Ozer reviewed 5 studies; Ohly et al. (2016) included 40 studies in their review of the literature concerning the health outcomes from students experiencing a SG. The majority of the outcomes reported by the authors were positive for GBL. A study conducted in New Zealand by Utter et al. (2015) used a large sample of students (N = 8500) to investigate the effects of having a SG on fruit and vegetable consumption, fast food consumption, physical activity, and body mass index (BMI). In addition, their analysis attempted to determine if the presence of a SG moderated the effect of household poverty on BMI. Participating students and schools were chosen at random. Data in the form of a 608 item self-report survey and measurements of weight and height were collected by members of the research team. Comprehensive demographic data were collected and used in the regression analysis. Approximately half of the included schools had a SG (55%), and a similar percentage of participating students attended a school with a garden. Significance level was set at $p \leq 0.05$. Results showed that SGs were significantly associated with lower BMI and lower levels of fast food consumption. The analysis showed no significant impact on fruit and vegetable consumption. SGs appeared to buffer the effects of household poverty on student BMI as students experiencing household poverty had the greatest benefit.

The authors acknowledged several limitations to their study. The authors only considered the presence of a SG not how it was integrated into the curriculum or actually used by the participants. They did not explore the way the produce was used or how students experienced the garden. Data were collected throughout one school year and so some data were collected during the winter when gardens may not have been active. This could have dampened the effects of SGs on physical activity, fruit and vegetable consumption, and BMI. The measures used in the study for dietary indicators and physical activity were not tested for reliability and validity. Though included in the study's limitations, the omission of collected data pertaining to students' garden experience is disappointing as is the lack of considerations of reliability and validity. Such omissions undermine the impact of an otherwise well done and worthwhile study.

The literature shows that thousands of students are experiencing SGs with outcomes measured quantitatively and/or qualitatively. Experience is the first step for the students and the researchers. Subsequent stages of Kolb's model add depth and meaning to the GBL experience.

Reflective Observation

In the second stage of Kolb's model, students are to think about the concrete experiences they had in stage one. In the context of SGs, this can take the form of students reviewing and discussing the events that transpired while they were in the garden. Based on the descriptions of the research summarized in the previous section these discussions tend to happen with the guidance of their teacher or other trained adult. A sample of studies with larger sample sizes is detailed in the following paragraphs.

A quasi-experimental, posttest only study was conducted in Texas by Klemmer et al. (2005b). At the beginning of the school year, participating teachers for the treatment sample (n = 453) were trained in a SG curriculum developed by state agricultural extension agencies. Those teachers then used that curriculum for the entire school year (2000 – 2001) while the control group (n = 194) used standard teaching techniques. Teachers in the garden group led discussions of the students' GBL experiences. The program provided a teacher's handbook that provided activities for the students that enabled students to review and discuss garden events. Both treatment and control groups used the Texas Essential Knowledge and Skills (TEKS) curricular standards. Results showed that use of a SG demonstrably improved science achievement, especially for fifth grade students. The study sampled third through fifth grade students at seven elementary schools in one school district in Texas. The students' science achievement was measured by an instrument developed by the principal investigator, teachers, and curriculum specialists at Texas A & M University and the local school district (Klemmer et al., 2005a). The instrument aligned with the TEKS curriculum standards, and reliability analysis showed that the instrument had a Cronbach's alpha of 0.86. The instrument consisted of 40 items, and the scores were converted to a 100 point scale. Overall posttest comparisons showed that the treatment group that used GBL to enhance the regular curriculum scored 4.6 points higher ($p = 0.001$) than students in the control group who did not use the garden. In addition, fifth grade students in the garden group scored substantially higher, 14.9 points ($p = 0.00$), than the control group. Scores for students in the third and fourth grades showed no significant difference in test scores. The authors suggested that fifth grade students in the study were better able to relate the hands-on learning in the GBL program to their science curriculum because they had more advanced knowledge of the science than did students in earlier grades (Klemmer et al., 2005b).

The article's authors (Klemmer et al., 2005b) did not acknowledge possible limitations of their research. The study did not employ random assignment of participants to treatment or control groups. Instead teachers were allowed to self-select their students for participation in the study which meant that teacher enthusiasm for GBL could have impacted the results. Also, school district leadership had a role in determining which students were assigned to the treatment and control groups. The criteria for making the final assignment decisions were not included in the article. Participating teachers were given a full day of training in the garden program at the beginning of the school year. Not all participating teachers attended the training. Non-attending teachers were to get their program information from other participating teachers. The researchers did not account for, nor document, the fidelity of this secondary training. The researchers included demographic information pertaining to the age and gender of participating students; however, they did not include information pertaining to race, ethnicity, or socioeconomic status.

Other studies investigated the effects on fruit and vegetable consumption by students' participation in a GBL program through the use of diet recall diaries. In these diaries students reflected on the foods they have eaten in the garden, at school and at home. Christian et al. (2013) in their discussion of the effects of school gardening on students' diets found that students experienced improvements in nutritional awareness, health, and vegetable intake after being involved in a GBL program.

In association with the RHS, a cluster randomized study was conducted of the effects on school gardening on fruit and vegetable intake over 18 months (N = 641). In that study Christian et al. (2014) used food consumption recall diaries to collect data on food students ate. The researchers found that SGs could improve students' intake of healthier food options when the GBL program involved the home more and included cooking and eating opportunities at school. The effect was more pronounced for schools that had made an effort to improve their garden programs. They used a validated 24 hour diet recall diary, the Child and Diet Evaluation Tool (CADET), to track the students' intake of fruits and vegetables. The diaries were checked by fieldworkers to make sure they were being filled out correctly. The fact that the authors were comparing two treatments without a control group was a potential criticism of this study;

however, RHS had a policy involving access to their GBL programs that precluded the use of a non-treatment control group.

In the United Kingdom, the RHS supported the Campaign for School Gardening which began in 2007. The RHS commissioned the National Foundation for Educational Research (NFER) to determine the impact of school gardening on students' learning and behavior. As a part of this study, diaries were used by participants to record their thoughts concerning their GBL experiences. NFER did a qualitative analysis from a representative sample of 10 schools that participated in the Campaign. The 10 participating schools were selected using a randomized stratified sampling technique. The stratification was by performance on benchmark achievement tests. The schools were also chosen for their diverse location geographically and whether they were urban, suburban, or rural.

The schools were visited by researchers in summer and fall 2009 with each school treated as its own case study. Participants were given disposable cameras and diaries for record keeping during the fall of 2009. Visits were made to each school to gather data on academics, behavior, and social skills. Researchers also investigated the level to which gardening had been integrated into the school's curriculum and the wider community. Interviews were conducted with senior teachers, parents, students, and teaching staff designated as garden leaders.

The results of the NFER study, of which participant reflections were a key component, had outcomes that included greater scientific knowledge and understanding, enhanced literacy and numeracy, increased knowledge of seasons and food production, development of physical skills, increased responsibility, more positive behaviors, and improvements in emotional well-being (National Foundation for Educational Research, 2010; RHS, 2015).

Abstract conceptualization

The third stage in Kolb's model is the stage in which students make conclusions and create new knowledge. Having had the experience and reflecting upon it, students make connections with prior knowledge and develop new ideas. For GBL, this learning has been measured empirically by researchers evaluating the effects on SG programs on students. Findings concerned academic achievement (particularly science), fruit and vegetable consumption, nutritional knowledge, teamwork, self-understanding, leadership, decision making, communication, and volunteerism.

Mabie and Baker (1996) in their research on improving science education found that a well-run SG may do much to bridge the divide between a student and the experience of learning. A GBL project was used as part of their investigation of how hands-on learning can develop scientific skills in fifth and sixth grade students at two inner city schools in Los Angeles. Two classes of students were assigned to the GBL treatment (n = 56); two classes were assigned to a mini-project based treatment (n = 57), and one class was designated as the control (n = 31). The GBL group experienced a 10 week garden program developed by one of the researchers. The garden program was developed years earlier and used by the University of California Cooperative Extension Service in schools and communities in and around Los Angeles. The GBL program included one hour of garden instruction per week, delivered by the researcher that was divided into a 15 minute classroom session followed by 45 minutes in the garden. The mini-project treatment also was for one hour per week and included lessons involving baking bread, raising chicks, and germinating seeds. Both treatments emphasized skills related to observing, communicating, ordering, relating, and inferring in a scientific context. Qualitative assessment data were gathered pre- and post-treatment. The assessment consisted of comparing cooked and uncooked popcorn and observing 10 unrelated small objects. Results showed that for the popcorn phase of the assessment 27% of the control group, 48% of the GBL group, and 53% of the mini-project group improved in their responses involving scientific skills in comparing popped to unpopped popcorn. In the assessment that involved the categorizing of 10 various items based on their common characteristics, pre- to posttest comparisons showed that the percentage of students in the control group who could successfully complete the categorization task improved by 1% (49% to 50%), the GBL group improved by 37% (42% to 79%) and the mini-projects group improved by 45% (35% to 80%). The researchers concluded that participation in the experiential learning activities helped students develop and employ their scientific thinking abilities. They further concluded that the limited differences seen in the GBL program and the mini-projects program might be accounted for by the fact that 10 weeks was not enough time for the GBL projects to be fully completed whereas the mini-projects were all fully completed in the allotted time frame. The participants were chosen from schools that had administrators and teachers who agreed to participate in the study so some self-selection bias may have affected the results. Likewise, the researchers acknowledged that the generalizability of their study may be limited due to the narrow demographics of the population sampled.

In her review of the research literature on SGs, Blair (2009) found 12 quantitative studies that used a quasi-experimental, pretest and posttest design. These studies primarily included third through sixth grade participants. Of those 12 studies, nine showed significant positive results for an increase in learning outcomes regarding science achievement and food and nutrition knowledge. Klemmer's (2005a) science achievement instrument was used in two of the studies. The instrument has a reported Cronbach's alpha of .86. (Cronbach's alpha is the likelihood of a test reliably giving consistent results.) Though the amount of knowledge increase was generally small with varied levels of significance, the studies showed a consistent increase in science knowledge for students who used a SG compared to those students who did not. The food and nutrition knowledge was assessed via questionnaires, a six vegetable identification and taste test, and 24 hour food recall journals. One study employed a six month follow-up. Results were mixed with all studies showing some positive results in favor of GBL programs. The results of the quantitative studies showed an increase in science scores from pre- to posttest, and an increase in higher ordered thinking skills for the GBL condition. In addition, students who used a SG could identify vegetables better and were more likely to eat vegetables than their peers who did not participate in a GBL program. However, the gardening groups had little advantage over non-gardening groups in the development of nutritional knowledge. Blair was critical of the methods employed, especially regarding the tendency of the treatment groups to self-select (i.e., non-random assignment) and the lack of an attempt to match the demographics of the treatment and control groups. She also stated that four of the quantitative studies used assessment instruments that did not have proven validity.

In 2013, Williams and Dixon took advantage of the growing body of research pertaining to SGs and performed an analysis of the research published between 1990 and 2010. They searched 15 electronic databases for empirical research pertaining to GBL academic achievement and non-academic achievement. Academic achievement directly related to the standard school subjects of science, math, language arts, writing, and social studies. Additional inclusion criteria were that the research had to involve students having at least one hour of garden exposure every two weeks, the garden had to be school based, and assessment measures were to be specific to the age group being studied. Upon completion of their search they included 48 studies of various research methods including quantitative (50%), qualitative (23%), and mixed methods (27%)

studies of SGs. Of the 48 studies included in the analysis, 69% were quasi-experimental which was defined to mean that the included studies utilized a pre/posttest format but without randomized sampling. Late elementary students (third – fifth grade) were the most frequently sampled group, and 37 of the studies had a sample size greater than 100. They addressed the academic, social, behavioral, and health impacts of SG and found many positive effects. For academic effects, Williams and Dixon stated that 33 of the 40 studies that evaluated learning outcomes showed that gardens appeared to have a positive effect while six showed no change and one showed a negative effect. Of the 22 studies that measured direct academic outcomes, positive impacts of GBL included improved academic outcomes for science, math, writing, and social studies. Science had the highest percentage of positive outcomes. Fourteen of the 15 studies (93%) that focused on science achievement resulted in positive effects. Also 80% of the measured outcomes in math were positive, and 72% of the academic outcomes for language arts were positive. The authors did not discuss the details of the assessment tools used by the various researchers. They did include two criteria in the selection criteria that involved assessment – academic outcomes had to be measured, and the assessment measures had to be specific to the age of the students being assessed.

In spite of their concerns with the rigor of some of research they analyzed, the authors nevertheless stated that their synthesis found "a preponderance of positive academic outcomes especially in science, math, and language arts" (Williams & Dixon, 2013, p. 226), and they concluded that participating in a GBL program promoted higher academic outcomes. Students' science, math, and language arts scores benefited from the use of a SG; this effect was attributed to the SG being a direct, relevant, hands-on, learning experience.

Williams and Dixon (2013) expressed concerns with the methods employed by many of the researchers. Of the 48 articles included, 33 of them included a discussion of the validity of their assessment instruments, and none of the studies discussed threats to validity. The participants' socioeconomic status, gender, and ethnicity were included in fewer than half of the studies. Only five of the 48 studies included information on the demographics of the participating schools. A further limitation was that the authors did not discuss the details of the assessment instruments used in the individual studies.

A study conducted by Smith and Motsenbacker (2005) used treatment (n = 62) and control (n = 57) groups to evaluate science achievement in fifth grade students. The treatment group engaged in a 14 week garden curriculum, the Junior Master Gardener Program, while the control group did not participate. The pre- and posttest instrument was a 40 question test developed by Klemmer (2002), which had a Cronbach's estimate of reliability of 0.403. The test results were multiplied by 2.5 to convert to a 100 point scale. Each participating school's gardening space was standardized to three 4 x 10 foot garden beds per school. The students participating in the GBL condition received two hours of garden instruction one time per week. The analysis showed that science achievement for fifth grade students appeared to be positively impacted by a hands-on gardening curriculum. The treatment group's posttest scores were significantly higher (3.5 points higher out of 100 total points) than their pretest scores (p = 0.0167). The control group had no such effect (p = 0.3924).

However, there are a number of important limitations that could have affected the results. For example, no information was provided about gender characteristics of the participants though the researchers analyzed and discussed the lack of an effect due to gender in their analysis. Also, the researchers noted limitations with the fidelity of treatment which included the use of volunteers with limited training in the garden and poor coordination with classroom teachers. Also of concern is the reliability of the assessment instrument; a Cronbach's alpha of 0.403 is considered low, and this should have been acknowledged by the authors. The authors did not include precise demographic data of the participants, merely referring to the students as being predominantly African-American. While the study did provide some insight into how a GBL program can support student achievement in science, a more rigorous research protocol would have increased its importance.

In 2005, Robinson and Zajicek found that use of GBL helped improve students' life skills. Their study used the Youth Life Skills Inventory (YLSI) to investigate how participation in a GBL program affected teamwork, self-understanding, leadership, decision making, communication, and volunteerism in third through fifth grade elementary school students. The YSLI was developed as a three point Likert scale with the wording adopted from the 4-H National Youth Assessment survey and reviewed by a child development psychologist from Texas A&M University. The instrument was pilot tested with the result that two of the statements were made clearer and more applicable to elementary aged students. The resulting instrument was analyzed for reliability and found to have a Cronbach's alpha of 0.87. Possible instrument scores ranged from 32 to 96. The participating students were enrolled at 12 elementary schools in central Texas and divided into experimental (n = 190) and control (n = 91) groups. The treatment group received garden instruction using a garden curriculum developed by state extension agencies which focused on horticulture, health, nutrition, environmental science, leadership, developing volunteerism, and enhancing positive youth development. Participating teachers were trained in the garden curriculum and asked to complete a set number of garden-based activities throughout the school year.

Results showed that the control group showed no statistically significant difference in their overall pre- and posttest scores ($p \leq 0.05$), while the treatment group's overall scores showed a statistically significant increase of 1.5 points. The experimental group and the control group had pretest scores that were significantly different; the control group was 2.78 points higher. At posttest there was no significant difference between the control and treatment groups' scores. For the treatment group, significant differences were found for two of the life skill constructs, teamwork and self-understanding. No significant changes were seen in leadership, decision-making, communication, and volunteerism. The authors suggested that this may have been due to the complexity of those variables and the fact that they may have been influenced by a variety of non-garden factors such as family values and social factors. Teachers volunteered their classes for participation in the study which may have caused the included classes to be more enthusiastic about GBL. The authors did not discuss their criteria for placing classes in either the treatment or control group, so it is not known if selection was random or not. Furthermore, the authors did not discuss possible limitations of their research.

Savoie-Roskos et al. (2016) surveyed the literature in order to investigate SG's impact on fruit and vegetable (F/V) intake. They searched electronic databases for studies conducted from 2005 to 2015 that investigated the effects of a SG on students' consumption of garden produce. Their criteria for inclusion were that participants be between 2 and 15 years old, that the studies had to have been conducted in English, and in a developed country. The authors stated that all types of study designs were considered, though they actually limited their selection to quantitative studies only. Generally, the studies did employ pre/post assessments as well as intervention and control groups of participants. The authors' initial searches found 841 studies for inclusion, but most of those were eliminated due to duplications or failure to meet the above criteria. As a result 14 studies met the criteria and were included in the study.

The 14 studies were assessed using the Quality Assessment Tool for Quantitative Studies which rates quantitative studies on 8 categories – selection bias, study design, confounders, blinding, data collection, withdrawals, intervention integrity, and analysis (Thomas et al., 2004). Of the 14 studies, one was rated strong, one was rated moderate and 12 were rated weak. Half of the studies did not report validity or reliability of their findings, and the length of the garden interventions varied from 10 weeks to 18 months. Shorter interventions had no effect on F/V consumption. Twelve of the studies used student self-reports. In their evaluation of the studies' results, the authors expressed concerns with the use of convenience samples and associated issues with social approval bias. Only three of the studies used randomization of participants. Further, although the settings of the interventions were included in the report (school, after school, child care, community), the interventions were not described in detail.

Nonetheless, the authors drew several conclusions. Ten of the studies reported a statistically significant increase in fruit and vegetable consumption, though due to limited follow up, it is not known if any of the interventions resulted in long term behavior changes. The study rated as of moderate quality reported that fruit and vegetable consumption increased significantly ($p = 0.01$) in the intervention group but not in the control group. The study rated as strong showed that fiber intake increased significantly ($p = 0.04$) in the intervention group. In the same study, vegetable intake decreased less in the intervention group while there was no change in the fruit intake for either group. The authors concluded that garden interventions had an overall small positive influence on F/V intake. They suggested that limited access to F/V at home could have reduced the effectiveness of the interventions.

Active experimentation

The fourth stage of Kolb's model involves students incorporating their knowledge and acting upon it. As this stage concerns students' actions and outcomes after learning has occurred, research that went to this level was harder to find. Most of these studies were qualitative. Studies were found that evaluated body mass index (BMI), fast food consumption, F/V consumption, changes in school behaviors, enhanced physicality and attitudes towards school.

Parmer et al. (2009) found improvements in nutritional awareness for students who experienced a SG. They used three separate evaluation instruments, pre- and post-treatment, to determine students' fruit and vegetable knowledge, preference, and consumption. The sample consisted of six classes of second grade students who were divided into treatment (*n* = 76) and control (*n* = 39) groups. The treatment group was divided into a nutrition education only group (*n* = 37) and nutrition education plus GBL group (*n* = 39). Fruit and vegetable knowledge was assessed with an instrument adapted from Struempler and Raby (2005) with Cronbach's alpha > .70. Another instrument developed by Domel et al. (1993) and revised by Lineberger and Zajicek (2000) evaluated students' fruit and vegetable preference (Cronbach's alpha = .83). Since the students were young, seven to eight years old, happy, neutral, and sad-faced visuals accompanied the words on the form. Students were asked to rate their preference for carrots, broccoli, spinach, zucchini, cabbage, and blueberries. Four of the five vegetables were grown in the SG. Finally, actual student consumption of fruits and vegetables was observed in the school cafeteria during lunch. The observation of students' eating choices outside of the garden incorporates an aspect of active experimentation.

Results of paired t-tests showed that the nutrition education plus garden group was more willing at posttest to choose vegetables ($p < .01$) than the nutrition ($p = .82$) or control groups (p

= .466). The nutrition plus garden group also ate significantly more vegetables at posttest ($p < .01$) as compared to pretest while the nutrition only group had no significant change in consumption. Vegetable identification was likewise better at posttest for the garden group than for the other two groups. The authors acknowledged some limitations. The second grade at the participating school had an unusual gender breakdown with 80 male and 35 female participants. The authors reported that the gender distribution by group was not significantly different. Also, the authors stated that the study ideally should have been randomized, with a larger sample size and a follow up assessment to determine long term results. They also acknowledged that the generalizability of the results was limited by the sample being predominately white and exclusively second grade students. The authors were very thorough in planning, executing, and reporting on this study.

In a similar quasi-experimental study conducted in Australia, Morgan et al. (2010) examined the impact of nutrition education on students in fifth and sixth grade. The authors reported that students' willingness to taste vegetables, their rating of the tastes of various vegetables, and their ability to identify vegetables improved as a result of their use of a SG. The researchers used questionnaires and actual taste tests to obtain their results. Students were divided into three groups – a group that received nutritional education with garden use (n = 35), a group that received nutritional education without garden use (n = 35) and a control group that was waitlisted for receipt of the nutritional education program. The nutritional education treatment was a 10 week program that consisted of three 1 hour lessons per week. The garden treatment added to the nutritional educational component by putting that group in a GBL environment for 45 minutes four times per week. Results were obtained by comparing the garden group to the other two conditions. The relatively short duration of the treatment, 10 weeks, may have impacted the results.

As reported earlier, results of the NFER study included development of physical skills, increased responsibility, more positive behaviors, and improvements in emotional well-being (National Foundation for Educational Research, 2010; RHS, 2015). Blair (2009) found seven qualitative studies of SGs which used interviews, surveys, document analyses, focus groups, and observations. Her analysis also included three case studies that looked at specific gardening programs. The qualitative studies revealed that student pride, teamwork, and attitude towards school all increased for students who participated in a GBL program. Parents were more involved with their student's school, and SG demonstrated a strong community building component as a place of hope, growth, and motivation.

Upon completion of a systematic search of electronic databases, Google searches, and reference lists, Ozer (2007) found five peer reviewed studies that researched student outcomes for students who participated in SGs. All were quasi-experimental studies using pre- and posttest designs which examined the effects of a GBL environment on a total of 1,344 elementary and middle school students across the reviewed studies. Results of the analysis showed that experience in a GBL environment increased students' positive attitudes towards vegetables and their level of physical activity. The assessment instruments used by the various researchers were not described in the article, though one study was reported as using a 24-hour diet recall journal to determine whether or not students' eating habits changed. Ozer found one quasi-experimental study that showed that exposure to a GBL program improved attitudes towards school for girls but not for boys. The researchers who conducted the original study hypothesized that the care they took to provide treatment materials that were free of gender bias may have contributed to the improvement seen in the girls' attitudes towards school (Waliczek et al., 2001). Ozer (2007) advised that the wide variation in grade levels, limited sample sizes, limited tests for statistical significance, and the lack of information regarding the students' exposure to treatment programs undermine the usefulness of the results. She went on to recommend that future research include larger sample sizes, more rigorous designs, and more thorough analyses.

As further support for the idea that the knowledge obtained in a GBL program can be incorporated and acted upon by study participants, Davis et al. (2015) surveyed the literature and found 13 studies that showed that SGs had varying positive effects on participants' vegetable intake, increased preference for and improved attitudes towards vegetables, willingness to taste fruits and vegetables, and ability to identify vegetables. The studies generally involved students in late elementary to early middle school and had varying numbers of participants ranging from a low of 43 to a high of 764. The authors reported that there was no consistency in the measuring instruments used and that many of those instruments were not assessed for validity. None of the studies were randomized and so they may have some selection bias. The authors stated that all of the studies included a hands-on learning aspect that got the students involved in their school's garden, and that this likely contributed to the positive effects. Likewise having a cooking component, an instructor specific to the garden, and involving stakeholders such as teachers, principals, and community members appeared to improve student outcomes.

Williams and Dixon (2013) review of the literature also included aspects of Kolb's Active Experimentation component. They included 36 studies that assessed GBL's non-academic effects in their survey of the literature on SGs. These effects included improvements in student sociability, environmental attitudes, motivation, curiosity, discipline, study habits, problem solving, life skills, and academic attitudes. Most of the articles investigated more than one indirect outcome resulting in a total of 69 possible effects. The analysis showed that GBL's non-academic effects were 80% positive, 1% negative and 19% neutral. Williams and Dixon did not include details pertaining to the assessment instruments used in the included studies though they reported concerns with the rigor of some of the research. Their primary concerns focused on sampling and methodological procedures, which in their view negatively impacted the validity of some of the studies.

A survey of the literature on SG concerning their impacts on the health and well-being of students was conducted by Ohly et al. (2016). The authors searched multiple data bases for studies written in English, that involved a school, used a comparison group (quantitative only) and reported health and well-being outcomes. They included qualitative studies to examine students' SG experiences and what factors appeared to help or hinder the GBL's programs' success. After elimination of studies that were duplicates or did not meet the established criteria, the authors included 21 quantitative, 16 qualitative and three mixed methods studies. These studies focused on student characteristics related to student incorporation of knowledge obtained in the SG into their daily lives. The various studies tracked changes in attitudes towards school and self, BMI and physical activity levels, feelings of achievement, teamwork and cooperation.

The quantitative studies were evaluated by the Quality Assessment Tool for Quantitative Studies. A strong rating indicated no weak components. A moderate rating meant one weak component while a weak rating was the result of two weak components. The qualitative studies were evaluated using criteria used by Wallace et al. (2004). These criteria involved critical examinations of the research questions, context description, sampling, data collection, data analysis, reflexivity, generalizability and ethics. The authors reported using their own system for rating the qualitative studies, but they did not describe their system in detail. The studies were assessed by one author and then double checked by the other authors. Disagreements were resolved by discussion among the raters.

Of the quantitative studies, 14 were rated as weak and four were rated moderate. The results for the qualitative studies were as follows: two were considered strong, eight were rated as moderate and six were rated weak. The authors stated that when multiple publications reported data from the same study, they were assessed as one study which explains why the assessed number of studies does not match the reported number of included studies.

Approximately 75% of the studies took place at an elementary or primary school. The type of gardening interventions varied from purely garden (about 50%) to interventions that involved cooking and/or some form of nutrition education.

Thirteen of the quantitative studies reported participants' F/V intakes. Just two of those studies reported statistically significant effects; however, both used a non-randomized design with self-reported data. Six studies reported participant nutrient intake or other dietary outcomes. Four of those studies reported statistically significant changes in nutrient intake. Three of those four studies had limitations that included child self-reporting of data and changes in the control group but not the intervention group. The authors of one study only reported for three nutrients even though more nutrients were tracked in the study.

In their review, Ohly et al. noted that two of the quantitative studies reported physical health measures relating to physical activity, blood pressure and body mass index. One of the studies showed a statistically significant improvement in diastolic blood pressure although the study was not randomized and the blood pressure measurements were all within the normal range for school children. The other study utilized a questionnaire and accelerometers. The students reported being less sedentary ($p = 0.001$) and engaging in more moderate physical activity ($p =$

0.01) compared to the control group. The accelerometer analysis showed that there was no increase in light physical activity nor was there a reduction in sedentary behaviors.

Ohly and colleagues also reported that children's well-being was assessed in four studies only some of which used reliable and valid data collection instruments. These studies investigated quality of life, life skills and interpersonal relationships. Two of the studies did not find a statistically significant difference between the intervention and control groups at outcome. The authors stated that the other two studies did not adequately report the outcomes.

Eleven of the qualitative studies reported perceived nutritional benefits for students participating in a GBL program. The benefits included greater knowledge and awareness of F/V, improved attitudes towards new foods, and healthier eating habits. The authors included student quotes to support their nutritional claims such as "When I grow them [vegetables] I feel like I should always try it. And when I've grown them I like them better than the shop ones." (p.16)

Five of the qualitative studies described SGs as a place for physical activity. One study reported that SGs were a good place for students who have trouble concentrating in class. The physical activity was also reported as a way to enhance empathy for people who labor to bring students food. The authors stated that this positions SGs as part of a social, even moral, education.

Ohly et al. also reported that personal well-being impacts were found in 14 of the qualitative studies. These impacts involved feelings of achievement, satisfaction and pride from nurturing the plants. The authors commented on the connection with nature and the emphasis on empathy and caring. Twelve of the studies reported that students gained confidence and self-esteem by taking ownership and responsibility for their SGs. An included quote focused on a SWD who showed her confidence and developed leadership skills when working in the garden.

In five of the studies, students reported the garden as being a peaceful sanctuary where they could relax and let go of their daily stresses. Two of those studies included some students with ADHD, depression and behavioral difficulties. In general, students reported that the connection with nature, being outdoors, and focusing on physical work allowed them some quiet time for reflection and enabled them to process the stressors in their lives. One student stated,

> "It makes me feel good inside, all fresh, good… I enjoy touching the soil, the plants. You can feel them…I feel part of them…Yes, it makes me feel that I can care more about things… Being more gentle, caring more, the plants are like people." (p.17)

Social well-being impacts were reported in 11 of the qualitative studies. Participants reported enjoying interacting with their peers, teachers, volunteers and parents while working in the garden. Participating in a GBL program was seen as promoting teamwork and cooperation. Five of the studies reported that the cooperative efforts involved in gardening improved cultural awareness and cohesion. Parents from non-English speaking backgrounds felt more connected to their child's school via their participation in the school's garden program.

Two of the studies reported that students felt that participating in a GBL program had a positive impact on their academics. One student participant, who was identified as having ADHD, reported being able to finish their homework faster after de-stressing in the garden. Teachers and volunteers echoed these positive beliefs in four other studies.

Fourteen of the qualitative studies included factors that influenced the success and sustainability of GBL programs. Nine of them focused on SGs as a way to teach academic subjects experientially. Eight of them encouraged the integration of cooking or food preparation as a part of the GBL program. Five of the studies included descriptions of garden programs as leveling the playing field where students can participate equally without pressure or sense of competition. In summary, Ohly et al. found positive support for SG experiences as reported by students, including SWD, and parents.

SGs and SWD

Multiple searches on North Carolina State University's Library Summon system and Google Scholar using variations on search criteria "students with disabilities" and "school gardens" or "garden based learning" revealed little research that investigated SGs and SWD. In their exploration of the therapeutic effects of garden spaces, Smith and Aldous (1994, as cited in Bowker & Tearle, 2007) found that feelings of self-worth and self-confidence could be improved by gardening for students with mild intellectual disabilities. Hussein (2012) found that a sensory garden was helpful in improving responses in students with more profound disabilities. Students with mobility and communication disabilities took advantage of multiple and varied sensory experiences in a man-made sensory garden. The students felt and smelled herbs, flowers, and trees; they observed butterflies and tadpoles, and they listened to insects and water flowing. The qualitative data and analysis, while relevant and useful for the population studied, did not shed light on the experience of SWD who are included in the general curriculum and expected to master the associated learning objectives.

In their examination of how GBL programs could help improve science education for all learners at a large suburban elementary school with 23% of students identified as having special educational needs, Rye et al. (2012) found that:

> GBL provides an authentic and cross-disciplinary experience for all learners and can be easily adapted for students with disabilities. Because of the experiential, hands-on nature of GBL, this activity is one key to potentially unlocking the learning of students with disabilities (p.65).

Furthermore, the authors stated that in contrast to a traditional lecture based setting, SWD may be able to use the hands-on, real life experiences of GBL to enhance their level of learning. Rye et al. also included guidelines for beginning a GBL program and aligning garden activities with school curricula while accommodating the needs of SWD.

SG programs can also be used to develop practical job skills for SWD to assist in their transition from school to a real world setting. Swank and Huber (2013) investigated such a transitional program that incorporated a SG as one of its primary components. Students with behavioral disabilities planned, built and maintained their SG and then harvested and sold the produce. They developed job skills relating to coming to work every day, consistency of effort, problem solving, and social skills. The garden provided tangible consequences (plants dying, weeds taking over, and produce rotting) had the students' diligence dropped. During the year in which the program was in operation student behavioral referrals decreased 50% and the students' grade point averages increased by 0.17 points.

Chapter Summary

The body of research on GBL programs has focused almost exclusively on general education students. Other than those studies in the previous section, if SWD were included in a study it was without regard to their SWD status. Surveys of the literature, while citing concerns with method, are also supportive of GBL and its positive academic and non-academic impacts on students (Blair, 2009; Ohly et al., 2016; Ozer, 2007; Williams & Dixon, 2013). Other individual studies have shown the positive effects of GBL, but little research has been done that focuses on the impacts of GBL on SWD. This study investigated the impacts of a well-run GBL program on SWD in an attempt to fill that gap in the literature. The details of this study's methods will be discussed in the next chapter.

Chapter 3: Methods

This case study investigated the effects of a GBL environment on SWD at one elementary school. This study is a bounded, single case study of an elementary school with a functioning SG. Through incorporating various forms of data, this research study investigated how SWD experience a GBL program, how GBL affects access to the curriculum, the advantages and disadvantages of a GBL program and how a GBL program can be improved. Both SWD and teachers who use the SG were included as participants, and the qualitative data were collected via interviews, surveys, and observations. The units of analyses were individual students and teachers. By the triangulation of those multiple data sources, a detailed description of the GBL program and its potential impacts on SWD at the participating school was developed.

The use of such a method was suggested by Williams and Dixon in 2013. As part of their recommendations for future research, they suggested "A bifurcated research strategy looking at both the micro as well as macro levels of garden-based learning—small groups as well as school and district levels—would be useful, since gardens, like gymnasiums and laboratories, affect the whole school" (p. 224). This study investigated the "micro level" data.

Qualitative data were obtained through interviews of students and teachers, surveys of students and teachers, and observations of students using the SG to add richness and depth to the description of the GBL environment. Together, the data provided insight into how SWD experience a SG, how GBL helped them academically and what they and their teachers saw as GBL's advantages and disadvantages. Students and teachers were also asked how the gardening experience could be improved.

Research questions

In discussions concerning Pragmatism, Dewey was said to have been committed to "naturalistic demonstrations" and the "experiential nature of learning and knowledge" (Maddux

& Donnett, 2015, p.66). Following a similar pragmatic theoretical framework, with its focus on "facilitat[ing] human problem-solving" (Pansiri, 2005, p. 196), the research question and sub-questions were developed as a means to obtain data relevant to participants' reflections of their experiences in the Oakdale SG. The inclusion of the sub-questions allowed for a more detailed analysis of how SWD at Oakdale function in a SG and helped determine how their experiences connected to their learning (Creswell, 2013). The qualitative data obtained were used to develop answers to the research question and the associated sub-questions:

- Research question: How do SWD experience learning in a SG?
    - Sub-question 1: How do SWD describe their experience in using a SG?
    - Sub-question 2: What do teachers and SWD see as the advantages and disadvantages of GBL?
    - Sub-question 3: How do SWD and their teachers believe a GBL environment assists SWD with accessing the general curriculum, particularly in math and science?
    - Sub-question 4: How can GBL be improved to assist SWD in getting the most benefit from the GBL experience?

In subsequent chapters, these questions were addressed through the development of a description, developed from multiple data sources, of how the participant SWD experienced learning in a GBL environment. The participants' voices, via quotes, constitute the bulk of the data obtained and are a necessary part of this qualitative inquiry (Patton, 2002).

Researcher Subjectivity

In modern qualitative research it is important for the researcher to acknowledge their potential impact on the study they have conducted (Creswell, 2013; Patton, 2002). There are some things about me, the researcher, which had the potential to impact how I conducted the research and how I interpreted the results. The two main concerns involve my family's association with experiential education and the fact that I have been a gardener for over ten years.

My older sister and her husband are now retired teachers who have been involved with Project Adventure and related outdoor activities for nearly 40 years. In their active teaching years I spent many hours helping them guide their students through the ropes courses that were set up behind their respective high schools. I also helped them with other experiential learning activities in which they engaged their classes. From those experiences I could see the benefits for the students as they came away from the activities with a greater sense of confidence and self-efficacy.

Additionally, I am a gardener. I have been digging in the dirt, raising my own vegetables, fruits, and herbs for 12 years. One of the first things I did after buying my first house with a decent sized yard was to plant blueberry bushes and build four raised gardening beds. I grew the standard assortment of backyard vegetables and enjoyed the freshness and taste of vegetables and fruits that I grew on my own. Every year I had my patience and care rewarded by the taste of grilled squash fresh from the vine or a delicious sun warmed cherry tomato.

I see great value in being in nature, growing my own food, participating in sports, and other activities that take me outdoors and learning by experience. I have found experiential education to be a valuable addition to the educational process both in schools and in life, and I wanted to explore how the potential benefits could help SWD find success. These inclinations might have colored my perspective on this research, but I employed measures such as member checking and triangulation of data to ensure that my conclusions accurately matched the experience of the SWD and teachers who participated in this study.

Participant Demographics

The county containing the participating school is a large urban and suburban district in the Southeast. Data for the 2018-2019 school year showed that the school district served 160,471 students and was 51% male, 49% female, with 45.8% Caucasian, 22.7% African American, 18.0% Latino, 9.3% Asian, 3.8% identifying as multiracial, and 0.4% American Indian, Hawaiian or Pacific Islander. Nearly 9% of the students were considered Limited English Proficient, and 32.1% received free or reduced lunch. SWD comprised 11.5% of the overall student population. The school district reported a per pupil expenditure of $9,670 for the 2019-2020 school year.

The participating school was set in a suburban/rural setting away from the main population center of the county. In the 2018-2019 school year, Oakdale had an average daily membership of 856 students with 75.8% Caucasian, 6.9% African American, 12.5% Latino, 4.0% multiracial, 0.5% Asian, and 0.4% American Indian, Hawaiian or Pacific Islander. By gender the school was 51% male and 49% female. Students identified as Limited English Proficient accounted for 5.0% of the student population, and 21.9% of students at Oakdale qualified for free or reduced lunch. Oakdale was not a Title 1 school meaning that it did not qualify for supplemental federal funding for low income students. The school had an overall grade level proficiency of 84.6% based on end of grade tests. Table 3.1 shows a comparison of reading, math and science end of grade test scores for Oakdale, the district and the state.

Table 3.1

End of grade test scores: school, district and state

End of grade test	Oakdale	district	state
Reading	78.2	64.9	57.2
Math	89.0	65.4	58.6
Science	90.1	71.3	72.6

Note: Number is percent proficient

Students who were economically disadvantaged accounted for 21.5% of the student population, and Oakdale had 87 students classified as SWD (10.2%). Performance on end of grade state tests showed that 28.2% of SWD were proficient versus 17.3% for the district and 13.9% for the state.

Teacher proficiency data for Oakdale showed that 34.6% of teachers were rated as “highly effective” with 65.4% rated “effective” and 0% rated as “needs improvement”. Further data on teachers are shown in Table 3.2.

Table 3.2

Teacher descriptors: school, district and state

	Oakdale	district	state
NBCT	25.0	15.1	11.8
4+ yrs. exp.	96.2	84.3	79.0
Turnover	3.9	10.1	-

Note: Number is a percentage. NBCT = National Board Certified Teacher

The SWD included in this study were those students with an IEP or 504 plan who were included in general education classes and were expected to learn the standard academic curriculum. Students and teachers were recruited separately and placed in their own independent participant groups. Thirteen students returned parental consent and their student assent forms. Of those students eight (62%) were male and five (38%) were female. All were Caucasian. For the school year 2018-2019, the grade distribution of the SWD participants was eight fifth graders, two fourth graders and three third graders.

Twelve teachers returned signed informed consent forms. All were female and Caucasian with one identifying as Latina. In the school year 2018 – 2019, the teacher participants included four fifth grade teachers, two fourth grade teachers, four third grade teachers, one first grade teacher, and one kindergarten teacher. Eleven (92%) of the teachers had 4 or more years of experience as a teacher. Likewise, 11 (92%) of the teachers had four or more years of experience using the SG.

Research Design

An internet Google search that focused on the central region of North Carolina revealed a set of schools that might have a working SG. Emails were sent to the schools' principals to determine whether or not the school had a garden and if so, if that garden was used to support students academically. One county was found to have an elementary school, Oakdale, which has had a functioning SG that has been used for academic purposes for several consecutive years. This school was the focus of a pilot study conducted by me and was found to have a well-run, well maintained SG that was utilized as a way for students both with and without disabilities to access the standard curriculum (Barrett, 2013). Publicly available demographic data showed that this school had a student population of just over 1000 students which included nearly 100 students who had been identified as qualifying for special educational services either through having an IEP or a 504 plan.

Prior to conducting research at the participating school, appropriate school and district personnel were contacted regarding the research plan that was submitted to the university's

Institutional Review Board (IRB). The research plan was then submitted to the research review department of the participating school district for their approval. Upon obtaining approval from North Carolina State University's IRB and the school district, the principal at the elementary school was informed of the research with suitable details and their cooperation requested and attained. Potential participants, students, their parents, and teachers were asked to give informed consent and to agree to their voluntary participation in the research. The IRB application included proper safeguards that were taken to ensure that no identifying information was made public and protocols were put in place to protect participant confidentiality.

All names used in the written report are pseudonyms and the master list of participating students and teachers was generated, secured, and protected. As is the case for this document, when this research is eventually published, names will be replaced by reference numbers, and pseudonyms will be used to refer to participants in the text any manuscript derived from this dissertation and any potential and subsequent articles published thereof. Personally identifying information associated with any of the initial data was removed by me upon receiving their signed informed consent/assent forms. Non-participants' names and any other associated data were discarded, and a master list of participants was generated.

Lists were obtained of SWD who had either an IEP or 504 plan, were in the third, fourth or fifth grade, and participated in the general curriculum. Older elementary students, third through fifth grade, who had experienced learning in the SG for at least one year, were the focus of this study. Potential teacher participants were recruited with the assistance of the principal at an after school faculty meeting. All teachers were considered as potential participants.

A short, preliminary survey was attached to the student assent form for those students to complete and return should they agree to participate in the study. This survey included questions that determined what places and what activities the students saw as supportive to their learning. The initial survey was to determine whether students spontaneously indicated the garden or GBL activities were important to their learning. The students were to have been put into two groups – one group who spontaneously included the garden as an important place to learn and one group who did not.

As it turned out, only one student spontaneously indicated that the garden was an important place to learn. As such the initial plan to have two pools of students could not be used. Similarly, the teachers were to have been placed into two groups – garden users and non-garden users. All the teacher participants were garden users; therefore, they could not be placed into two groups.

As is the case with much of qualitative research, the participant sample was purposeful and convenient (Miles et al, 2014). The purpose was to see how SWD utilized and experienced a SG and whether or not GBL supported SWD academically. The school's location and the fact that it had a functioning school garden made it convenient for me.

Data Collection

The process of collecting data began with classroom teachers of the potential SWD participants facilitating the distribution of the parent and student informed consent forms (Appendix A). The entire faculty was asked to participate in this study and given the opportunity to fill out a teacher informed consent form (Appendix B). Participant lists were generated from the returned consent/assent forms.

An observation data sheet, interview questions, and survey questions were used previously in a pilot study I conducted. The observation, interview, and survey data were collected in formats similar to the pilot study that informed the research procedures for this project (Barrett, 2013). The interview and survey questions were modified to fit this study's research questions. Their design followed from the literature on qualitative instrumentation, and they had a similar structure to allow for consistency across observations and interviews but with allowances made for incorporating unexpected data (Miles et al., 2014).

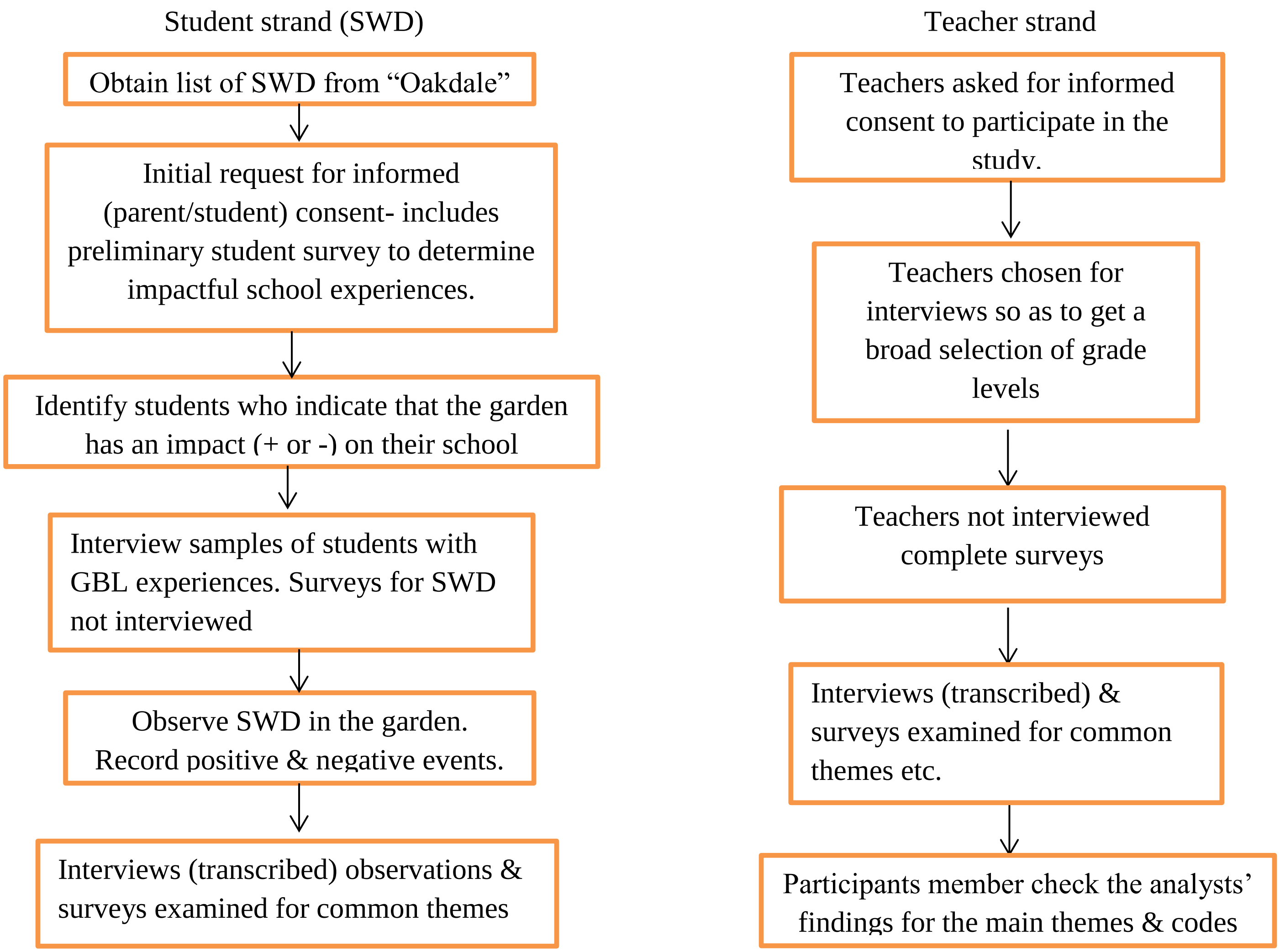
The interviews were designed to be semi-structured. This was done to enhance the consistency of data across participants, and to allow for probing and follow up questions (Miles et al., 2014; Yin, 2009). The interview questions were derived from the research question and sub-questions for this study (Creswell, 2013) and are listed in Appendices C and D. The teacher interviews were conducted individually. Teachers were chosen for interviews so as to get a broad selection of grades taught. One-on-one interviews allowed for greater attention to be given to the subject, more in depth follow up questions, and the development of rapport between the interviewer and the subject (Creswell, 2013). Eight students were interviewed in groups of twos and threes in various quiet, otherwise unused rooms. The setting of the interviews did not appear to influence the data collection process; the students responded well and participated freely as focus groups. All interviews were recorded with a digital recorder placed in plain sight between the interviewer and the subject(s), and participant permission to record was obtained.

A survey was conducted to expand the data collection to include students and teachers for whom an interview was not practical for scheduling reasons, and to improve the validity of the data. This second data source allowed for triangulation, provided corroborating evidence, and generated another set of data that could be analyzed for codes and patterns. The survey questions mirrored the interview questions for the students and the teachers respectively. The survey was conducted using the Qualtrics software package to ensure confidentiality and security. Lexile levels of the questions were checked beforehand to ensure that the language was suitable for third through fifth grade students. One online Lexile evaluator, lexile.com, showed the text to have a median Lexile level of 505 which is appropriate for mid- to upper-elementary students. As circumstances allowed, I assisted the students with reading the survey questions. Three SWD took the student survey, and five teachers took the teachers' version.

The observation data sheet (Appendix E) had headings to identify the place and time of the observation and allowed space for descriptive and reflective notes (Creswell, 2013; Patton, 2002). The observations were conducted during the fall of 2018 and the spring of 2019 on days when the weather had little impact on the experience of the students and teachers. This was done to eliminate variability in weather as a potentially confounding variable. Data were collected on one SWD per session. I observed as a nonparticipant so I could record data without direct involvement in the garden activities and without distracting the students or otherwise interfering in their garden experience (Creswell, 2013; Yin, 2009). A flow chart of the research process for this study can be seen in Figure 3.1.

Figure 3.1

Research Process Flow Chart



Data Analysis

Analyzing data for a case study can be difficult (Yin, 2009). Even though employing a pragmatic lens allows a certain amount of flexibility in qualitative data analysis (Creswell, 2013), the method of data analysis described below did follow protocols derived from the qualitative literature. Generally, the process involved "assigning codes …to transcripts or documents … sifting through these materials to identify similar phrases [and] relationships … elaborating a small set of assertions … and generalizations" (Miles et al., 2014, p. 10).

Data analysis began with the interview responses being reviewed by me and a second rater trained to determine the important comments that were relevant to the research questions. A training session was conducted in which the two raters, myself and the second rater, went through the first few pages of an example transcript together. This was to provide guidance and training for the second rater so they could later recognize significant quotes on their own. The results of the example interview were discussed between the two raters. Discrepancies were either resolved by both raters agreeing on the quotes' significance or allowed to remain as discrepancies. In isolation, each rater then selected important quotes from each student interview and each teacher interview. Interrater reliability was determined via comparison of the selections of the two raters and will be discussed in more detail in a later section. The use of two raters served to improve the reliability of the study (Patton, 2002). The raters' analyses were compared and discussions held to come to an agreement as to the salient data points.

As the more experienced researcher, I looked for subsequent patterns in the codes across the data (Creswell, 2013) and developed the categories and resultant themes. In analyzing the initial codes, I looked for repeated ideas within each set of data – the interviews, surveys, and observations. The initial codes and the categories developed from those initial codes are shown in Appendix F.

The salient quotes were assigned as initial codes to the research questions to which they were relevant. Teacher and student survey answers were likewise assigned to the research questions as initial codes. The sub-questions all involve data obtained from teachers and students and, since the observation data did not include student or teacher descriptions of the SG, the significant observational data were assigned to the research question. A software package, Qualitative Data Analysis Miner (lite), was used to organize the selected quotes as initial codes for the research question and sub-questions. Then for each research sub-question, categories were determined from the initial codes that had been assigned to each research question. This was done by "relying on theoretical propositions" (Yin, 2009, p.130). Many of the main ideas (categories) derived from the initial codes were taken from the research literature as reviewed in chapter two. Allowances were made to include new categories derived from data unique to this study. Repeated ideas in the initial codes also played a role in the development of the categories. Subsequently, 17 categories were generated from the initial codes. These same categories were then applied to the observational data assigned to the main research question. In a similar fashion, using the premises of previous research and seeing ideas repeated in the codes and categories, themes were developed and form the main results of the study.

Reliability and Validity

As the data were analyzed attempts were made to improve the study's validity and reliability. To increase the likelihood that the initial codes were significant and worthy of inclusion in the analysis, two raters read the interview transcripts and independently chose salient quotes (Patton, 2002). Initial inter-rater reliability (IRR) was determined for each interview by dividing the number of mutually agreed upon significant quotes by the total number of significant quotes. Subsequently the two raters had a discussion to resolve discrepancies in the selected quotes with discrepancies either resolved through mutual agreement or allowed to stand as discrepancies. Then a final IRR was calculated for each interview by dividing the revised number of agreed upon quotes by the total number of chosen quotes. Results are shown in Table 3.3. The mean IRR values of 82% (initial) and 96% (final) show that the analysis of the interviews began on a reliable footing. The final IRR agreement of 96% is well above accepted minimums (Creswell, 2013).

Table 3.3

Initial and Final IRR Percentages

Transcript	Initial IRR	Final IRR
Student interview 1008, 1003 test	73%	100%
Student Interview 1001, 1006, 1012	84%	98%
Student interview 1005, 1010, 1011	78%	97%
Teacher interview 305	80%	90%
Teacher interview 306	81%	93%
Teacher interview 307	87%	93%
Teacher interview 311	90%	100%
Mean IRRs	82%	96%

Data from interviews, surveys, and observations were used in this study, and triangulation of those three data sources served to enhance the validity of the study (Creswell, 2013; Patton, 2002). Also, teacher participants who were interviewed were asked to member check the transcriptions of their interviews. Each teacher was sent a copy of their interview via email with instructions to read the transcript and report any significant errors. All teachers stated that their transcription was an accurate representation of their interview. In another round of email communication, the teacher participants were asked to review the main themes of the study. All teacher participants reported that the main results, the themes, were an accurate representation of SG usage at Oakdale Elementary. Students were interviewed in groups of twos and threes making a member check for their interviews impractical. In addition, I included a researcher positionality statement to disclose any potential researcher bias that may have affected this study. Member checking of the study’s conclusions, using multiple forms of data, and the inclusion of the voices of the study participants via quotes should have mitigated the effects of such bias.

External validity in qualitative research, especially case studies, is fraught with difficulties (Miles et al., 2014). The external validity of this study is minimal due to the low numbers of participants, their lack of diversity and the lack of the replication of results. Patton (2002) used the term transferability in considering whether or not a qualitative study's findings might relate to another situation with a similar context. In that light, these findings may transfer to other elementary schools with parallel circumstances.

The possible influence of the Hawthorne effect needs to be recognized as participants may have responded differently knowing they were participating in a research study. This might have been particularly true of elementary aged children.

Chapter Summary

The methods outlined above describe how data were to be gathered on how SWD and their teachers perceived SGs and their impact on student learning for SWD. Participants' demographics were described in detail. This research study incorporated interviews, observations, and surveys. These qualitative data were gathered at the participating school at the individual level for SWD and their teachers to shed light on the GBL experience for elementary students with special education needs who were included in the general educational curriculum. The results of this investigation will be presented in the next chapter.

Chapter 4: Results

This chapter presents the results of the study with the data organized by research question. The results consist primarily of participant quotes from the interviews and surveys that show their reflections of their garden experiences. Data from the observations are also presented.

Data were obtained from 11 of the 13 students and nine of the 12 teachers for an 80% response rate. Two teachers did not respond to their survey prompts, and one teacher interview could not be scheduled. One non-participating teacher did not send her two student participants to be interviewed or surveyed.

Data for the sub-questions came from interviews and surveys from SWD and teachers. Specifically, eight student interviews, three student surveys, four teacher interviews, and five teacher surveys generated data for these questions.

Sub-Question#1: How do SWD Describe Their Experience in Using a SG?

The raters identified 83 salient student quotes that were considered as initial codes for this research question. Three categories were developed from the initial codes. The categories were “students do”, “students feel”, and “students learn”. The frequencies of the categories for this research question are presented in Table 4.1.

Table 4.1

Sub-Question 1: Codes and Categories

Initial Codes - 83	Categories - Codes
	StuDo - 39
	StuFeel - 23
	StuLearn - 21

Students reported engaging in a variety of activities in the SG. They planted vegetables, pulled weeds, harvested produce, observed insects and other wildlife, tasted new foods, put down mulch, raked leaves, watered the plants and reported that they were able to use up energy which helped them focus later. Students reported liking eating the garden produce: “I have never tried squash until I tried it here and I love it now.” and “I like getting the food. It’s better than cafeteria food.”

Other students described their accomplishments regarding the basic care and functioning of their SG – “I have raked leaves, put down mulch, dug potatoes.”, “I helped plant a cherry tomato.”, “I planted carrot seed and pulled out weeds.”, “I do like to dig, harvest stuff”. One student reported caring for the plants: “So sometimes like there would be old plants that are about to die so we would kind of like …she would tell us the plants we need to pick so it can grow new ones… .”

The observational data supported students being active in the SG. Such initial codes included “1002 notices that another student has found a sweet potato, and he starts digging.”, “1014 is still weeding. Focused.” and “[he] is weeding well with appropriate social interactions.”

All of these activities were readily facilitated by the SG. SWD were engaged in doing things that gave them hands-on experiences with interesting creatures, seeing plant and animal life cycles as they happen, tasting new foods, and gaining satisfaction from helping in the garden.

The students reported how they felt in the garden. Of the 23 initial codes applied to the category StuFeel, 15 were positive, five were negative, and three were neutral. Students reported feeling happy and relaxed in the garden most frequently; also, they were interested in the garden activities or were at least not bored. Multiple student quotes expressed this positive aspect of SGs - “It’s calm.”, “I feel happy” “I had a lot of fun with it and I just think it’s awesome.”, and “It feels … it's hard to explain. It's a really good feeling." Some negative comments included fears or anxieties concerning insects, getting dirty, the hard work involved with gardening, and the fact that growing vegetables takes " … a long time". One student was overheard saying that "My arms are itchy." SWD often do not feel good about being in school (Nelson & Harwood, 2011) so providing a place for them to learn, be social, and feel good may help offset the negatives associated with their academic or physical difficulties.

In their interviews, for example, SWD expressed that they learned curriculum-based lessons in the SG. Twenty-one initial codes were assigned to the category StuLearn. The students reported that their garden activities included science, math, caring for garden plants, and healthy eating. One student mentioned art but primarily as decoration for the garden. Science was the most mentioned curricular subject. Students reported hearing about the water cycle, ecology, ecosystems, and an eco-colony in connection with their garden visits. Students stated that "We learn kind of like the water cycle and she said something about the garden with it, how like it rains and like that kind of stuff.", " It teaches you about what garden spiders can help the plants." and "bugs cause disease and stuff for plants.". Also, students appreciated learning about plants and plant care as one student stated "I like to learn about plants. I think it's interesting and fun," and another student said:

> Say if a bunch of kids are crowded around one little plant bed thing, then the teacher will kind of like tell us about it and I think that's really cool because I like to learn about plants. They're interesting.

Students reported experiencing various kinds of insects and plants. The variety of animals encountered in the garden made an impression on one student: "and I also know there's caterpillars, butterflies in the garden and a lot of crawly animals and snakes. And spiders. And there's a lot. Crickets.” and “Sometimes there will be like different kinds of spiders and stuff and I like to see where they like to go.”

Interestingly, when students were asked directly if they did schoolwork in the garden, they all said no, but upon further questioning they readily mentioned the aforementioned science topics, math (counting), art (as decoration), and learning to eat new foods. This followed from the student responses to the initial question “Where do you like to learn at school?” as only one student of 11 mentioned that the garden was a good place to learn. The student participants appreciated the fact that the hands-on experience of the garden made learning about the garden environment more interesting and accessible.

Sub-Question #2: What do Teachers and SWD See as the Advantages and Disadvantages of GBL?

One hundred eleven initial codes were identified that applied to this research question (see Table 4.2). Those initial codes generated nine categories that included both advantages and disadvantages of the SG. Of the 111 initial codes, 90 (81%) were associated with advantages and 21 (19%) were associated with disadvantages. Advantages (adv) included positive behavior (Behav), novel experiences (Novelexp), new foods (Newfood), learning (Learning), and feeling good (Feelgood). Disadvantages (disadv) were found to be negative feelings associated with being outdoors (Negfeel), barriers to mobility (Barriers), the fact that it is hard work (Work), and the perceived disconnect with the curriculum on the part of the students (Currdiscon).

Table 4.2

Sub-Question 2: Codes and Categories

Initial Codes - 111	Categories - Codes
	advBehav – 19
	advNewfood – 14
	advNovelexp – 19
	advFeelgood – 13
	advLearning – 25
	disadvWork – 1
	disadvBarriers – 2
	disadvCurrdiscon – 6
	disadvNegFeel - 12

Participants reported several examples of how the garden impacted student behavior. One student stated that his participation in class activities and his focus increased due his involvement with the SG. He said, "It did get some of my energy and stuff out so I could actually focus better." One student was asked if he fidgeted while in the SG. He replied, "No, because I'm usually at work or something." Another teacher echoed the student's comment about hand-on activities with "They seem excited to be part of the hands-on learning experience." In referring to high energy, easily distractible students one teacher stated, "Sometimes the students are calmer when going back to the classroom because they were able to get some energy out". Another teacher elaborated further:

> I definitely see with those students a higher engagement versus sitting in a classroom and being easily distracted by a movement in the classroom or somebody saying something or

the clicking of a pen where in the garden they're in that environment and I just see that engagement level more with them.

Other teachers also appreciated the way their students behaved in the SG. One said, “Children who are sometimes severe behavior problems in the classroom, I’ve never had a problem with them in the garden.”, and another teacher reported “There’s less redirection for them to get on task because they’re focused. They get hyper focused on it at times.” As hyperactivity and distractibility are defining characteristics of ADHD, a frequently occurring high incidence disability (Barkley, 2006; Friend & Bursuck, 2012), this is an important finding. One SWD and several teachers saw participating in GBL program as a way to mitigate the difficulties with hyperactivity and attention that many SWD struggle with.

Teachers saw positive social interactions in their class while they were in the SG. One teacher reported, “It kind of gets them more involved with what their classmates are doing or saying.” Another teacher stated, “I’ve seen some of my more obnoxious kids … or the more outspoken kids, kind of shine in an environment like the garden.” Both students who were observed were very polite and appropriately social without becoming too distracted from their assigned tasks. Some recorded observations included “ … is weeding well with appropriate social interactions.” and “ … [he] nicely asks other students to move so his partner could move past.”

Student participants appreciated the opportunity to try new foods. One student said, “I liked the kale chips and the squash,” and another student said that the food from the garden was “awesome.” One student explained further “What I like is sometimes some of the actual like garden people, they will take samples out of the garden and bring it to the classroom so we can try the samples.” Other students reported liking cabbage, sweet potatoes, squash and green beans as foods they liked from the garden. Two students reported an appreciation of kale chips – "[I] especially liked the kale chips because they had a lot of salt on them …" and "I like the kale chips …"

Their teachers were also enthusiastic about this advantage of the garden. One teacher said, "Sometimes it's raw. Sometimes it's sautéed. The kids love it. Everybody can't wait to try it." Teachers reported getting messages from surprised parents marveling at the new, healthy vegetables that their children were now eating at home:

> Sometimes we have pickles and salsa and cabbage and eggplant, cucumbers, carrots, rattlesnake pole beans. You name it, we have it and the kids get to taste it. I often get emails from parents asking me how I got them to eat this or that and what was the recipe.

In a similar vein, another teacher said,

> I hear a little bit of feedback from parents – zucchini, squash, tomatoes, things that a lot of five year olds usually will not try just because of the way it looks. I think it's really helped open up them as far as eaters and some of them say "wow, I liked it."

Even students with sensory issues were reported to be more willing to try new foods they had helped grow in the SG:

> I know one year I did have somebody who had an aversion to texture and their mom was surprised that they were eating some of the things out of the garden that they would never have eaten at home and I know that that is part of when you are out there growing it and seeing it, it heightens your expectation and kind of excitement towards trying it and they did and they liked it.

As reported by both SWD and their teachers, the direct, hands-on involvement of the students' participation in the garden program made them more receptive to trying new foods.

Another advantage of the garden was the opportunity for students to experience things that they would not otherwise (novel experiences). A student reported seeing a snake "slithering up the fence." Another student recalled watching a bird nest via a web cam: "There was a bird nest near the school garden with eggs in it, and we got to watch it from the TV." How many elementary-aged children (or people of any age) can say that they grew and ate their own popcorn? One student appreciated the experience: "I know their (sic) harvest popcorn." In her exchange with one student with sensory issues, one teacher reported some quick thinking in getting the student to participate in planting seeds. Her exchange started with her asking the student:

> Would you like to put your finger in the dirt to make the hole, that's how we do it? and "no," [he] didn't want anything of that. So, we gave him a Popsicle stick and he was able to do it.

As previously reported in the data supporting research question #1, students reported feeling good (AdvFeelgood). One student summed up how she felt in the garden by saying, "It's kind of like super quiet but there's really like nature songs. It's kind of peaceful." Teachers also stated that their students felt good about being in the garden. One teacher said, "Yes, in the past and this year as well my students with disabilities really enjoy the garden. They like the jobs and there are many ways for them to help."

Students reported learning about science and, to a lesser extent, math (Adv Learning). The SWD in this sample identified science lessons involving the water cycle, life cycles, and basic research while math lessons focused on counting insects and weighing the garden produce. One student mentioned art as decoration for the garden.

Teachers reported a wider variety of curricular tie-ins. Teachers were very enthusiastic about the science connections the garden provides, and they also mentioned math, nutrition, and writing. Six of the teachers described the hands-on nature of the GBL experience as positive. One teacher summed it up, “It is and also a hands-on, eyes-on version of the curriculum. They're not just hearing it or reading about it. They're actually seeing, experiencing, touching, feeling. That really helps to accommodate all different kinds of learners.” Another teacher said,

> They're in charge of their learning. They can freely explore. The garden is very hands-on. I would greatly miss that garden. I mean I've been here a long time and we haven't always had that garden and I really think that it's enriched the learning drastically with kindergarteners.

To assist SWD in particular one teacher reported that she used graphic organizers when she took her classes to the garden, “I give it to the whole class but the primary [purpose] for the graphic organizer are for my students of lower needs so they have something to be able to write down and make that connection.” Graphic organizers allowed SWD and other students to make connections which improve memory and recall (Aran, 2007). In general, teachers reinforced the idea that the garden helped not just SWD, but all students make better connections to the science curriculum. Comments from participants concerning other school subjects were limited.

Disadvantages of visiting the SG were reported to be negative feelings, a perceived disconnect with the curriculum, physical barriers for SWD, and the garden being hard work. Fears of insects and itchiness were the primary negative feelings with students saying, “I'm afraid of being stung by a bee,” and in response to “How do you feel in the garden?” one student replied, “Scared and weird. A little scared and itchy a lot but it's worth it.” One student who used a wheelchair suggested that her access to the garden was limited by the uneven ground and the fact that she could not participate in the mostly ground level activities. She was supported by two teachers who also reported that the garden could be made more user friendly for students with mobility issues.

Some students did report other negative aspects of the garden program. One student stated very directly that the garden “is hard work.” Another student, when asked why he did not choose the garden as a favorite place to learn, said that the garden “takes a long time.”

One unexpected finding was the fact that when asked initially, every student participant said that they did not do curriculum based activities in the garden. When asked specific questions about doing schoolwork, however, they reported the aforementioned activities involving science and, to a lesser extent, math. The following exchange played out in every student interview:

Did you learn any school subjects in the garden?

A1: No. A2: No.

Teacher participants provided many responses which formed the initial codes associated with learning (56%) and positive behavior (79%) while the SWD provided most of the quotes (62%) about feeling good in the garden. Having negative feelings associated with being outdoors was the most frequently mentioned disadvantage. Teachers provided 67% of the initial codes associated with negative feelings while students provided 33%. Even though the teacher participants were very enthusiastic about using the garden, they were not blind to possible negative feelings their students might have such as interactions with insects or discomfort with touching the soil.

The SWD participants were very positive about their garden experiences as the garden experience let them relax, be active, and encounter novel experiences in an academic setting. Teachers reported that their SWD were well behaved while in the garden. Teachers also related their memories of having students who had negative feelings about the garden. As stated earlier, for this research question, positive initial codes were more numerous than negative ones by a four to one ratio.

Sub-Question #3: How Do SWD and Their Teachers Believe a GBL Environment Assists SWD with Accessing the General Curriculum, Particularly in Math and Science?

SWD and their teachers were all asked about school subjects that were discussed in and around the SG. Forty-four initial codes were generated that applied to this research question. Eight of the 44 initial codes (18%) came from students; 36 (82%) came from teachers. Categories were generated concerning science, math, and “other” curricular connections. The science and math categories were derived from the literature and were mentioned with some frequency by this study’s participants; “other” was use to represent those of aspects of the curriculum that were mentioned by the participants but did not involve science or math. The breakdown is shown in Table 4.3. Twenty-six of the 44 initial codes (59%) associated with this question concerned connections to the science curriculum. Both teacher and students responded that science was a part of their gardening experience. Students initially said that they did not do “school stuff” in the garden, but when asked about it directly they related experiences associated with science, math and art. Every teacher participant mentioned tie-ins with the science curriculum as one of the main reasons for using the garden. Five of the 44 initial codes (11%) were associated with math, and 13 of the 44 initial codes (30%) were associated with other aspects of the curriculum.

Table 4.3

Sub-Question 3: Codes and Categories

Initial Codes - 44	Categories - Codes
	CurrSci- 26
	CurrMath - 5
	CurrOther – 13

Science was the most commonly reported curricular subject. Specifically, life cycles of insects and animals, plant ecology, weather, abiotic vs. biotic factors, being scientists, types of soil, composting, and creating a hands-on, real world laboratory for learning science were reported. One student said that their teacher had emphasized the water cycle on one of their garden visits, “I mean one time my teacher said something about let's say we learn kind of like the water cycle and she said something about the garden with it, how like it rains and like that kind of stuff.” One student reported investigating bird life cycles through a webcam. The webcam allowed the student to watch eggs being incubated and then hatching. Another student reported doing research concerning insects, “I think we did like, we went outside a couple of times in the week and then we went to check out all the bugs and we were like doing research stuff.” One student stated that she learned about plants, “I like to learn about plants. I think it’s interesting and fun.” When asked what science topics they studied in the garden, one student said, “The ecosystem” and another student replied, “We made an eco-colony.” A student liked learning about garden plants using an activity their class did in the SG,

> They also have this wheel that you spin and you spin the wheel and then you get a different type of plant and then it talks about the plant. Like there's corn. …then the

> teacher will kind of like tell us about it, and I think that's really cool because I like to learn about plants.

Teachers reported many connections to the science curriculum. One teacher stated that she used the garden to enhance teaching students about plants and soils, "Our curriculum includes a plants and soils unit and so I do try and relate our science to the garden." A teacher reported that she used the SG to enhance her students' "Interest in ecology and the plant life cycle beyond what we learned in the classroom." Another teacher reported using the garden as a demonstration of the requirements for life, "… understanding living things, what the needs are of living things and that includes human beings, animals and plants as well.", and weather " … It also correlates greatly with our weather unit. … We've got wind flags. We've also got some other instruments out there that we go out there and look at. We've got rain gauges and the kids are measuring the rain …" One teacher reported specifically using the garden to enhance her teaching of abiotic and biotic factors,

> Part of our curriculum in science is teaching ecosystems and I like to take the kids to the garden when we're learning about the abiotic and biotic factors that an ecosystem needs in order to survive so we go to the garden and the kids go with the T-chart with abiotic and biotic factors on each side and they have to make identifications of the different organisms and non-organisms in the garden and be able to differentiate between the two.

One teacher responded to the survey question "What subjects do you emphasize in your garden visits?" with "science (plant life cycles, types of soil, composting)". Another teacher's survey response was "Real world, hands-on experiences to supplement ecosystems unit and life science standards." During one of the observations the lead teacher talked to the students about insects and cotton and their stages of growth.

Math connections were also reported, but in fewer number than science. Two students reported counting while in the garden with one of them saying, “One year we counted the number of plants.” One teacher said that students also weighed the produce, “… but then what we harvest is tasted by our school and all of our leftover produce heads to third grade where they weigh it.”

Curricular subjects apart from science and math were also mentioned. One student reported working on art for the SG, and teachers stated that, while in the SG, their classes worked on writing, nutrition, social studies, art, and life skills such as cooperation and teamwork.

Sub-Question #4: How Can GBL Be Improved to Assist SWD in Getting the Most Benefit from the GBL Experience?

Teacher and student participants were all asked how they thought the SG could be improved. Twelve initial codes were found that related to this question. Two categories were developed, one concerning improving the garden’s structure (ImproveGBL-structure) and the other involving improving garden activities (ImproveGBL – doing). These results are shown in Table 4.4.

Table 4.4

Sub-Question 4: Codes and Categories

Initial Codes - 12	Categories - Codes
	ImproveGBL-structure - 7
	ImproveGBL – doing - 5

Of the initial codes concerning the structure of the garden, three had to do with improving access for students who use wheelchairs. Other ImproveGBL - structure comments concerned the care and upkeep of the garden. Teachers and students both had good suggestions for improving the structure of the garden. As mentioned previously, one of the student participants, who used a wheelchair, was disappointed in the lack of access; she reported having a very difficult time navigating the garden and taking part in the garden activities. Specifically, she said, “maybe pathways instead of mulch between the garden boxes so I – it's easier for me to get through instead of getting stuck in the dirt and mulch they have and getting stuck on weeds and bumps.” A teacher echoed that sentiment in saying, “We've talked about putting in like a rubber sidewalk and such for wheelchair access,” and another teacher elaborated further,

> I have not had a student in a wheelchair in my classroom, but I just try and think about how those students would be able to maneuver around the garden, and I don't see that happening. [I] wonder if maybe there's some ways that we would be able to incorporate wheelchair-accessible activities within the garden for those students.

A more general suggestion came from a student who said, “The wood boards that make the garden square… some of those are falling off.” Another student suggested, “I'd want to be able to use a drip irrigation system.”

The second category was generated from the suggestions for improvement that dealt with having more to do in the garden. Most of those suggestions were about taking better care of the garden, while some of the initial codes involved wanting more activities to do while in the garden. Students reported concerns with weeds.” …I look at it and I see a lot of weeds in there…” All of the initial codes associated with appearance and having more to do came from student quotes: “I think the garden needs more care”, “have more stuff to [do],” and “If maybe like more people would help.”

Interestingly, most of the teacher participants did not offer any suggestions as to how the garden could be improved, though all were asked. Only two of the teachers offered suggestions for improving the SG. Four of the five teachers who took the survey did not answer the question concerning possible garden improvements at all, and one teacher wrote “I think it’s great as is.” On the surface, the fact that only 12 initial codes were generated for this research question suggested that the participants considered Oakdale’s SG to be well run and maintained; however, biases from pro-garden attitudes and the participants not wanting to say anything negative about their SG may have affected these results.

Research Question: How do SWD Experience Learning in a SG?

The data obtained from the observations did not fit under any of the research questions as every one of the research questions was concerned with what teachers and/or SWD thought about some aspect of the SG. Obviously a visual observation cannot determine what a student is thinking, only what he or she is doing, although intentions can be inferred based on the social context of the observed actions. The decision was made to apply the categories obtained from the four research questions to the observation data. In that way the observational data were used to enhance the quality of the data assigned to the research questions.

Thirty-one initial codes were generated from the two observations. Of those initial codes, 13 were assigned to the categories StuDo (42%) and 11 were assigned advBehav (35%). Other codes generated were categorized as StuFeel, advNovelexp, advFeelgood, StuLearn, and disadvNegFeel. The initial code counts are presented by category in Table 4.5.

Table 4.5

Research Question: Codes and Categories

Initial Codes - 31	Categories - Codes
	StuDo – 13
	advBehav – 11
	advNovelexp – 1
	advFeelgood – 1
	StuFeel –3
	disadvNegFeel - 1
	StuLearn - 1

As would be expected, both observations showed that students were engaged in doing various garden activities (StuDo). The number of initial codes associated with good student behavior was not expected (advBehav). In my previous visits to Oakdale's garden, the students had been more distracted and had more trouble staying on task (Barrett, 2013). For this study, during both observations the SWD were engaged, appropriately social, and worked well both alone and with their peers. One of the observed students was distracted for a short time, but that did not detract from the quality of the experience. The students were observed to be smiling, and one of them was overheard requesting more garden work so he apparently felt good about working in the garden. The particular garden sessions I observed were not designed to involve the curriculum so such categories as CurrSci, CurrMath, and StuLearn were only minimally reported.

Both garden sessions were work sessions with weeding and harvesting produce as the main activities, but both students seemed to enjoy their time in the garden. Student 1002's session included an initial segment during which students were to dig up sweet potatoes. Both observations lasted approximately 35 to 40 minutes. The weather was nice both days and not a factor in the observation. In the first observation, the student participant (1014) who was being observed was assigned a student partner who had a more limiting disability. Early in the observation, 1014 nicely asked other students to move so his partner could get past. The student participant did a good job balancing the garden work with keeping his partner engaged while being socially conscious of his other classmates. After emptying a few buckets of weeds, student 1014 was overheard saying that he needed more work showing that he was enjoying himself and was invested in the experience. His behavior was exemplary (advBehav) and he was very busy doing (StuDo) what he was asked.

During the other observation, student 1002 was also observed to enjoy his time in the garden and, like 1014, he was well behaved, worked well, and was attentive to his surroundings, teachers, and peers. He did not appear to be completely focused on getting the work done, but he pulled weeds, dug up sweet potatoes, and was patient as needed.

Early in the observation, while the teacher leading the group was talking, student 1002 was observed to move closer to the teacher, gloves in hand, listening quietly. He showed focus and interest. He did get distracted for a brief time when he became engaged with one of the signs posted in the garden rather than looking for sweet potatoes. Upon switching to weeding, he did a good job, once pulling a large weed that had to be broken up by the teacher. He got the teacher's attention by raising his hand and waiting patiently for her to attend to his large clump of weeds. For most of the observation, student 1002 was smiling, productive, social and only occasionally distracted during the session. Late in his session he noticed another student had found a snail, and student 1002 was curious and interested in seeing the snail.

The frequency of the categories StuDo and advBehav show that both students were active, well behaved, and generally appeared happy to be in the garden. They were adept socially, communicated, worked well with other students, and listened to directives or information from their teachers.

Themes

For the purposes of this research, themes were defined to be the result of the process of synthesizing the initial codes into categories which were then condensed into the common themes (Miles et. al, 2014). The categories and themes were primarily derived from the research literature with allowances made for data unique to this study (Yin, 2009). The common themes were intended to be the main outcomes of this research. Each theme listed below will be discussed in its own section.

- SWD felt good about participating in the garden program
- GBL allowed SWD access to the curriculum, especially in science
- SWD were active while in the SG
- Positive behaviors were evident for SWD in the garden
- GBL provided hands-on opportunities for learning beyond the curriculum

SWD Felt Good About Participating in the Garden Program

SWD can find school to be a difficult and unhappy experience (Nelson & Harwood, 2011). Participant SWD who used the garden at Oakdale were quoted 15 times in initial codes stating that the SG was a place where they felt good. The students who were observed were involved in the garden activities, interacting with their peers, and smiling during their time in the garden. Fifteen of the 23 initial codes applied to the category StuFeel were positive with five negative and three neutral. An example of these positive feelings about the garden was expressed by one SWD as “It's like gardens and … dirt are my happy places.” Several students reported concerns with insects and itching, but one of those students added “it’s worth it”. Teachers also noted that their SWD felt good while in the garden - “so their behaviors definitely do change. Their faces light up. You see the smiles. You see the excitement,” and “I mean we're talking four or five months where the kids are just ecstatic about everything going on out there.” Another teacher reported that “For some they seem more content and I would say that for most all students they are happy in the garden.” Students self-reported that the garden was a relaxing place for them as one said, “it’s like putting my feet up on my desk.” School can be a difficult place for SWD so an activity that is viewed positively can be a foundational support to their education.

GBL Allowed SWD Access to the Curriculum, Especially in Science

In spite of an apparent student disconnect with how the garden allowed them to access the science curriculum, both SWD and their teachers acknowledged that science was an important part of GBL. Six SWD reported not doing any school subjects in the garden, but upon further questioning they discussed topics from the science curriculum, math curriculum, and to a lesser extent, art and nutrition. Every teacher participant mentioned science as their main curricular reason for using the garden. Teachers accounted for most (59%) of the 26 initial codes associated with science. Teachers also mentioned math, nutrition, literacy, social studies, and writing. One teacher summed it up:

> We talk about being scientists and how we as young learners are scientists and what do we use, our five senses, what do we hear when we're out in the garden, what do we see, what do things feel like and so it correlates strongly with our science unit.

Students and teachers at Oakdale also mentioned math as one of the main curricular connections for the SG but to a much lesser degree than science. Five initial codes were found associating math with the garden. Counting, weighing, and word problems were all mentioned. The use of the SG at Oakdale to support their math curriculum was minimal in comparison to the representations in the literature. To an even lesser extent, social studies, art, health, and history were reported.

Positive Behaviors Were Evident for SWD in the Garden

Both students and teachers reported positive behaviors for SWD while using the SG. Nineteen positive behavioral initial codes were reported by students and teachers while 11 more positive behaviors were recorded during the observations. Students reported better focus, liking to work with their hands, and getting energy out. Teachers reported similar experiences and emphasized that they had not had any bad experiences with student behavior while in the garden. If they had a student with some sensory issue, they worked to accommodate the issue and the session continued. Teachers were uniformly very pleased about their students' behaviors while doing GBL activities and reported: "There's less redirection for them to get on task because they're focused," and "Sometimes children with behavioral disabilities, somehow the garden kind of magically focuses them." Students said that they were able to use energy and so focus better while in the garden and after returning to the classroom. Also, the hands-on nature of the garden activities led one SWD participant to say, "If it's involved with my hands I do usually do it."

SWD Were Active While in the School Garden

The SWD reported in their interviews, were seen by their teachers, and observed to be active while in the garden. The category StuDo included 52 initial codes associated with it from student reports, teacher comments, and direct observations. SWD performed a variety of garden tasks: planting seedlings, watering, weeding, digging, and harvesting. A teacher stated that “Yes, my students with disabilities were interested and engaged in the garden, for the most part,”, and another teacher reported “Have certain students work off some energy, something different to do, gets them up and moving, it helps out our school,” and a student added “what you do in the garden is you rake leaves, you put mulch, you water the plants”

GBL Provided Opportunities for Learning Beyond the Curriculum

The participant SWD had valuable experiences in non-curricular areas. The observations showed that SWD functioned well in the garden as they demonstrated good behavior by following directions, interacting positively with their peers, and listening to their teachers. Student 1014 had an opportunity to assist a fellow SWD and showed solid leadership, patience and care in doing so.

One teacher reported, “His mom emailed me after a few times of doing it, and she was amazed at the fact that he was coming home and telling her about this vegetable that he just tried.” Another teacher said,

> And so I like to take them out and I like them to just wonder and to see things and to wonder what they are and to get excited and they call me over and ask me what this is and we talk about it.

Though none of the SWD participants reported it, students at Oakdale did assist food insecure members of their community by contributing some of the vegetables they grew and harvested. This was reported by one of the teachers when she said, “But then what we harvest is tasted by our school and all of our leftover produce heads to third grade where they weigh it and then we donate it to the local food pantry.” Another teacher stated that SWD “… can all help with different jobs and in the garden, they can share strengths that may not be seen as strongly within the classroom," indicating that the garden can be an equalizer for students who may feel less capable in a general classroom. Other teachers reported that "All of the curriculum elements and the healthy living and community service, and it was just fabulous for a well-rounded child," and "These are such student led activities instead of things that I necessarily have planned so they really do love those experiences." Teachers felt that the garden helped SWD feel successful and gave them opportunities to be leaders.

Chapter Summary

The data began as significant quotes which were labeled with initial codes and then grouped into categories. From those categories, themes were developed which summed up the significant results of the data. It was clear from the data that for SWD using the garden was a positive experience, with a few exceptions. While using the SG they felt happy, had access to the curriculum, particularly in science, had new and novel experiences related to new foods and activities, all while demonstrating positive behaviors. While the reported data were mostly positive, the effects of pro-garden biases need to be considered. The implications of these results will be discussed in detail in the next chapter.

Chapter 5 Discussion

This chapter includes a discussion of the main findings of this research. As a part of that discussion, I have interpreted the key findings, and showed their connections to the literature. Implications for future research will be discussed as well as implications for how gardens can best help SWD get the most out of GBL programs. Subsequent sections will present the limitations of this research and its connection to theory. Finally, this research will be summarized, and final conclusions will be presented.

Key Findings

The data were analyzed through a process that began with salient quotes being designated as initial codes. These initial codes were put into categories that generally matched the main propositions from the research literature (Yin, 2009), and then the overarching themes were determined from the categories. The themes are intended to be the main results of this research study. The themes were:

- SWD felt good about participating in the garden program
- GBL allowed SWD access to the curriculum, especially in science
- SWD were active while in the SG
- Positive behaviors were evident for SWD in the garden
- GBL provided hands-on chances for learning beyond the curriculum

Despite a few mentions of discomfort from being exposed to insects, dirt, and itchiness, most SWD expressed that being in the garden was a pleasant experience. Teachers stated that their students were excited to participate in the growing of vegetables with two teachers referring to their students as being “ecstatic” about helping with the garden. Students referred to the garden as a “happy place” and “relaxing”.

Teachers and students identified many curricular connections that can be made in a GBL environment. Every teacher participant stated that having the opportunity to bring the science curriculum to life was one of the main reasons for them to involve their students in the garden program. The student participants likewise mentioned science most often as the subject with which they are most involved in the garden. Other curricular connections reported by students included math and art while teachers reported that math, social studies, and writing were part of their students' GBL experience. When asked in general terms - "Do you work on schoolwork in the garden?" - student participants reported that they did not work on schoolwork while in the garden, but when asked directly - "Do you work on science?" for example - they then mentioned curricular connections involving science, math, and art.

Students were physically very active while in the garden. The observed SWD were busy harvesting vegetables, digging up weeds, carrying and dumping buckets of weeds, and interacting with their peers. One student showed great leadership in guiding a peer SWD with a more involved disability through the garden. Students also reported watering, planting seedlings, mulching, and carrying produce into the building. Physical activity, the "hard work" associated with gardening goes hand in glove with a GBL program. Some students may not like having to do activities they perceive as work. Physical activity has been reported in the literature as a benefit of a SG (Grow et al., 2010; Ozer, 2007; RHS, 2015), though, of course, not all participants may appreciate that. Young people are increasingly more sedentary (Grow et al., 2010) so getting students outside and active is another positive impact of a GBL program (RHS, 2015; Utter et al., 2015).

Students and teacher participants described positive behaviors associated with using the SG. Students said they were able to focus better in the garden and use pent up energy which let them focus better in the classroom. They fidgeted less while in the garden and upon returning to their classroom, and, by being actively engaged, they were not bored. Teachers stated that students were well-behaved in the garden, including those students whose behavior could be troublesome in the classroom. Teachers also saw higher levels of engagement among SWD, and they reported that the hands-on nature of the GBL program put SWD and students without disabilities on a more level playing field. Teachers also reported higher levels of focus for SWD with behavioral issues as they participated in the GBL activities. The students who were observed displayed good focus and appropriate social skills while performing their assigned garden tasks.

Students and their teachers described benefits of a SG that went beyond that of learning the curriculum. When being observed in the garden, student participants displayed leadership, cooperation, appropriate socialization, and a developing work ethic while completing their assigned garden tasks. Teachers reported that they saw the same positive traits. Students and teachers both stated that students, including SWD, routinely sampled new foods and parents told teachers that they were surprised that their children were trying and liking new, healthier foods. Patience is necessary to see plants start as seeds or seedlings and grow and develop into mature, fruit bearing plants. This exercise in perseverance has been seen as a benefit of SG for over 100 years (Nature Publishing Group, 1910).

As part of the GBL experience at Oakdale, student participants reported that they had the fun experience of growing their own popcorn and then eating it. Also as part of the Oakdale garden experience, SWD had the opportunity to feel a sense of satisfaction from seeing and eating the fruits of their labor and from contributing food to the local food bank which helped feed less fortunate members of their community. As reported by the teacher participant who was the driving force in getting the garden started, the contribution to the local food bank built on the connection with the community that started when the garden was first built and continues with annual visits from local agricultural organizations such as Future Farmers of America (FFA) and a local university's agriculture students. Incidental experiences in the garden also contributed to students' awareness and appreciation of nature (Keniger et al., 2013; Williams & Dixon, 2013). Students got to experience such things as eating new, healthy foods, watching eggs hatch via a webcam in a bird house, seeing a snake slither up a fence, and a spider wrap up its prey all through their participation in Oakdale's GBL program.

Interpretations

SWD gained benefits from a GBL program in similar fashion to their non-disabled peers. In this study SWD had access to the curriculum, particularly in science, were well behaved in the garden, felt good about being in the garden, liked eating garden produce, and were active and excited to experience nature. The perceived negatives described by some students – itchiness, dirtiness, and other sensory limitations - were either overcome by the SWD themselves or mitigated by quick thinking teachers. This allowed students with sensory concerns to be involved in the GBL program. This agrees with the previous research for non-SWD students from Blair (2009), Davis et al. (2015), Ozer (2007), RHS (2015) and Williams and Dixon (2013). Feeling good, comfortable and relaxed is significant for SWD who are often anxious about being in situations where they feel less able to be successful than their non-disabled peers (Nelson & Harwood, 2011).

SWD were able to access some aspects of the science curriculum through their participation in Oakdale's GBL program. The elementary science curriculum sets learning standards that include life cycles, identifying organisms, weather over time, changes in the environment, food from the environment, the effects of vitamins and exercise and the details of plant ecology (North Carolina Department of Public Instruction, 2019). Teachers emphasized these science connections and, once prompted, the participant SWD related several specific instances of the garden connecting with their science lessons. Students reported doing activities involving the water cycle, life cycles, and ecosystems. In the interviews and surveys, teachers emphasized that bringing the science curriculum "to life" was one of the main reasons that they participated in the GBL program. This result agrees with the literature as Rye et al. (2012) reported that SWD had improved science knowledge due to their use of a SG. The literature also showed that students without disabilities improved their understanding of science through participation in a GBL program (Blair, 2009; National Foundation for Educational Research, 2010; RHS, 2015; Smith and Motsenbacker, 2005; Wells et al., 2015; Williams and Dixon, 2013).

A major disconnect was evident in the student perceptions of the SG as a place to learn and the teachers' enthusiasm for using the garden to teach science. Only one student spontaneously reported the SG as a place for learning, and all SWD participants answered "no" when initially asked about doing schoolwork in the SG. All of the teacher participants stated that using the SG for science instruction was one of their main reasons for using the garden. The teachers at Oakdale may need to do a better job of communicating the curricular connections to their students.

Math curricular connections were reported but were limited in number. This finding diverges from the extant literature for students without disabilities from Blair (2009), the National Foundation for Educational Research (2010), RHS (2015) and Williams and Dixon (2013). In those studies, GBL math connections were reported at a level just below that of science. SWD at Oakdale stated that they had counted plants and insects during their garden visits. Teachers generally referred to the potential for incorporating math connections into the GBL program, but that there was no consistent use of the garden for math other than the third graders weighing the produce that came from the garden. Being made aware of more explicit curricular connections may help teachers and students better access the math curriculum. As compared to the literature, the SG at Oakdale appeared to be an underused opportunity for math instruction. Williams and Dixon (2013) reported in their literature survey that GBL can include themes in geometry, algebraic equations, probabilities, data analysis, and measurements.

As activity levels have dropped for children in this new gadget-oriented century, concerns have grown regarding childhood obesity (Grow et al., 2010). These lower activity levels have been associated with negative health outcomes such as a higher incidence of type II diabetes, a greater prevalence of child obesity and an overall shorter life expectancy (Grow et al., 2010; Richardson, 2011). Physical activity can counter that trend (Utter et al., 2015).

Although this study did not investigate the effects of a GBL program on these specific health concerns, the participant SWD's described many different activities they engaged in while visiting the garden. Teachers described their students as eager to participate in the garden program, and the SWD expressed their interest, with a few reservations, in GBL. Students stated that they dug, pulled, carried, picked, walked, and did a variety of other jobs as part of their garden experience. These actions were confirmed by the observations. Participants in a GBL program move, and while this likely does not rise to the level of physical exercise for most students, it is an improvement on spending the day passively sitting in a classroom. This was also observed by the National Foundation for Education Research (2010) and Ozer (2007) who reported enhanced physical activity for typical student participants in a SG program.

Though links between garden use, nutrition and obesity were not investigated directly in this study, getting young people active and engaged in outdoor activities is becoming more challenging in the 21st century (Committee on Physical Activity and Physical Education in the School Environment et al., 2013) so this finding is significant as it shows that a GBL program has the potential to counter the sedentary tendencies of today's youth (Grow et al., 2010). SWD participants and teachers reported students harvested, weeded, planted, dug and watered in the SG. Observational data confirmed that SWD were active while in the garden.

Both teacher and student participants described the positive behaviors of SWD while in the garden. This was confirmed in the observations; the students were seen to make appropriate use of their time in the garden. They listened well to teacher directions and information, were polite and considerate of their peers, and did the jobs they were assigned to do. Teachers and participant SWD recognized that the SG allowed SWD to be active while learning. This use of energy was recognized by both teachers and students as a means for some students with hyperactive and fidgety behaviors to improve their focus and attention. SWD can have challenging behaviors, so the multiple reports from students and teachers as to the positive behaviors of SWD as they used the garden at Oakdale were a significant finding. Though SWD behavior was not investigated in detail as part of this study, the positive behaviors were reported across settings by teachers and students. The settings were the garden and the classroom after a garden visit. Improved behavior and discipline has been reported previously in the research literature on SGs for students without disabilities. The National Foundation for Educational Research (2010), RHS (2015), and Williams and Dixon (2013) all reported improvements in non-SWD behavior associated with the use of a SG.

An important aspect of the garden was the way students gained positive school-based experiences beyond academics. In their surveys of the literature, both Blair (2009) and Williams and Dixon (2013) stated that indirect, non-academic benefits for typical students who participated in a GBL program included such things as positive social outcomes, increased motivation and enthusiasm, an improved sense of self, teamwork, and community. As the aforementioned outcomes were for typical students, the fact that this study showed similar results for SWD is important. Appropriate socialization, peer to peer interactions, opportunities for leadership, and developing a sense of community were reported by students and teachers and seen in the observations. Such opportunities can be hard to come by for SWD in a regular classroom.

Non-academic positive outcomes were likewise reported in the literature on SG. Ozer (2007), Blair (2009), Williams and Dixon (2013), Parmer et al. (2009), Christian et al. (2012), Keniger et al. (2013), Robinson and Zajicek (2005), RHS (2015), Utter et al. (2015) and Davis et al. (2015) reported outcomes involving improved sociability, increased willingness to try healthy foods, improved emotional well-being, more nutritional awareness and improved teamwork.

Suggestions were made for improving Oakdale's SG. One of the student participants used a wheelchair, and the layout of the garden made it difficult for her to feel fully engaged. The pathways were too bumpy and irregular for her to negotiate the garden without difficulty, and the beds were too low for her to dig in the dirt. Two of the teachers reported this as well. In a previous observation of Oakdale's garden, the garden did have a raised bed – literally a garden bed elevated on legs and filled with soil – that allowed students who used a wheelchair to have a space in the garden designed for them (Barrett, 2013). Other suggestions were made involving taking better care of the garden and having more activities available.

Implications for Future Research

This study was an attempt at extending the literature on GBL to SWD, and it agreed with much of the qualitative research done to date for typical students. Future research should employ quantitative data for SWD in a GBL setting to see if such data match, or can add to, the other quantitative literature. As reported by Blair (2009) and others, the methods used in such research must be well thought out and executed. One possibility for future quantitative analyses could be a comparison of standardized test scores or learning levels for SWD in a GBL school versus SWD in a non-GBL school. The obvious academic topic for such a study would be science, but math could also be considered. Two of the studies surveyed by Ohly et. al (2016) indicated that students felt that spending time in a school garden helped their overall academic performance. Expanding on that idea, a study could investigate the idea that involvement in a GBL program might have an effect on SWD’s overall academic success.

As shown by the research literature (Blair, 2009; Williams & Dixon, 2013) and this study, science is the school subject that is most connected to learning in a SG. Future research could take a focused look at math in a GBL environment to see if SWD and their teachers can develop the same level of academic connections and enthusiasm for math as has been shown for science.

The development and ongoing care of Oakdale’s garden involves corporate sponsors, parents, community organizations, and other educational/agricultural agencies such as FFA and collegiate agricultural students. Future research may show that SWD develop a greater sense of community through participation in a GBL program, particularly one like Oakdale’s that contributed produce to local food banks and involved many contributors from outside the school.

The SWD participants expressed that they felt good in the SG. Garden use could be tracked while measurements were taken concerning self-efficacy, attitudes towards school, or personal well-being. Similarly, SWD feelings of anxiety could be tracked using an age appropriate instrument to see if the use of a SG can create a calming effect for these students who may have struggles both in school and at home.

A detailed investigation of SWD behaviors could be done that includes a quantitative comparison of behaviors in the classroom versus the SG. A non-participant observer could track teacher redirects and/or time on task for SWD both in the classroom and in the garden.

Implications for Practice

One of the main findings of this study was that SGs help SWD feel better about being in school. A GBL environment appeared to give SWD a space at school in which they could feel less anxious and more relaxed. Since school can be an anxious place for SWD, having a place at school where their academic concerns are lessened may improve their attitudes towards school.

One of the teacher participants stated that taking her class to the SG was like going on a field trip. For schools that have a SG, such a "trip" to a learning space that generates student excitement and enthusiasm while allowing them to access the science curriculum makes SGs an effective tool that educators can use when working with students who struggle in a typical classroom. Trips to the SG also allow SWD leadership opportunities which may build their self-confidence.

In addition, SWD learned to like new foods, experienced nature, and learned as a part of a community. These novel experiences generated excitement and allowed for SWD to be active in a social setting. Many SWD struggle socially so a SG can be useful to educators who wish to include SWD in student social groups with their typical peers.

The results of this study also showed that SGs can mitigate troublesome behaviors by allowing students to move, “get energy out” and learn while doing. While students’ classroom behaviors were not observed as a part of this study, teacher participants reported that students with behavior concerns were less worrisome in the garden than in the classroom. Students were encouraged to explore while in the garden, and this freedom to roam, within some sensible safety and behavioral limitations, allowed students who might feel confined in the classroom to be a part of a social learning experience. Several teachers reported that the garden was “an equal playing field” that allowed students who struggle in the classroom an opportunity to shine and feel successful at school.

Some students with particular disabilities, such as emotional disability and autism, can have behaviors that are problematic in the classroom (Friend & Bursuck, 2012). Having a place at school where they can exhibit positive behaviors and develop social skills by interacting appropriately with their peers may lower their social anxiety and develop their self-confident which, in turn, may help them be more successful in school.

Here it should be noted that Oakdale’s garden was 3000 ft^2 and was developed with over $10,000.00 in initial funding. In addition, the teachers who developed Oakdale’s garden were passionate and committed to making it the best garden possible (Barrett, 2013). Even though developing a SG can be a daunting task, money does not have be an obstacle to starting a GBL program. Williams and Dixon (2013) reported that, of the 18 schools in their survey that reported their socio-economic status, 15 were considered low income.

Limitations

The main limitation of this research study was the fact that the participants were self-selected. I had no control over which teachers and SWD agreed to participate. As a result, the participants were likely to have a favorable impression of the garden, and that could have skewed the results towards the positive. Though certainly a concern, the self-selection of the participants was appropriate for the study as the research question and sub-questions were concerned with the GBL experiences of SWD and having participants who did not use the garden would not have contributed useful data towards answering those questions.

All of the data from the interviews and surveys were self-reported by the participants. Self- reported data is subject to error due to the possibility of flawed, selective or exaggerated recollection of events on the part of the participants.

Other limitations concerned the acquisition of data. The previously accessible garden website would have been a useful data source but was no longer available. The garden website had contained information concerning detailed curricular connections for garden activities, a garden use log and a pictorial record of garden usage (Barrett, 2013). Data on SWD free/reduced lunch status and the disability categories of student participants were not made available. The lack of data concerning disability categories was especially disappointing as matching SWD quotes and observed actions to their disability category might have added an informative level of detail to the findings.

Theoretical Perspective – Pragmatism & Kolb

Pragmatism has been described as being concerned with outcomes or that the "…meaning of human actions and beliefs is found in their consequences." (Kaushik & Walsh, 2019, p. 3). Pragmatism has also been associated with practical applications and solutions (Creswell, 2013). The problem of SWD underperforming their typical peers is seen in their test scores and their anxieties concerning school (Nelson & Harwood, 2011). Though not conclusive, this research did provide insight as to how SG can help SWD feel more confident at school.

Once developed, a well-run, well-used and well-maintained SG can become part of a school's culture. Learning science, being active, connecting with nature, allowing SWD to shine, and experiencing new things all have value, and those experiences may mitigate SWD's difficulties in school.

Kolb developed his model of learning from the pragmatic ideas of his predecessors. In his model, concrete experience is the beginning of the iterative cycle that subsequently includes reflection/observation, abstract/conceptualization, and active/experimentation. The cycle repeats as knowledge continues to be built from new experiences (Kolb, 1984). As discovered in this research, the garden at Oakdale Elementary provided a good way for SWD to gain those concrete, multisensory experiences that allowed them to access the science curriculum, opportunities to develop teamwork and cooperation, leadership, exposure to novel experiences, to participate in their learning, and develop a taste for new, nutritious foods.

The SG at Oakdale did function in an iterative fashion, though not in a way that fit Kolb's model. Kindergarten students planted seeds and cared for the seedlings. First and second grade students did the planting and some of the weeding. The older students in third through fifth grade did the harder garden maintenance and the harvesting (Barrett, 2013). As the students progressed through the grades they experienced subsequent iterations of the school garden, but no evidence was seen that they progressed from experience to knowledge as described by Kolb (1984).

As one teacher said," They [kindergarteners] see them grow from a seed to full and then in early May, we take all those plants and walk them out to the garden and then the first graders through fifth grades have a planting day and so the kindergarteners will go out there and watch this part." The teachers at Oakdale encouraged reflection through discussion of the experiences their students had in the garden. As one teacher reported:

> Great conversations go on out there whether it's weather or finding bugs or what's going on underneath the dirt or how some roots are above, some are below, some of the vegetables we eat are on top, some are below and they find things and we come in the classroom and we're at tables and I change the lesson for the day because that right there is the greatest moment for those kids to lead themselves in learning.

The garden experience for SWD at Oakdale fit well with the first two steps of Kolb’s model. Data were developed that did support the concrete/experience and reflection/observation stages. As this study was limited in scope, evidence was not seen of abstract/conceptualization and active/experimentation. Students at Oakdale were able to begin the learning process Kolb described with their garden experiences and ensuing discussions.

Conclusions

This research study was an attempt to broaden the extant literature on SGs. To date, very little research has been conducted that considered SWD in the context of a GBL program. The results of this study showed that elementary aged SWD experience a SG in a similar fashion to their non-disabled peers. They gained access to the science curriculum, demonstrated good behaviors, appreciated tasting new foods, and developed non-academic positive qualities involving teamwork, socialization, and feeling good in school. These benefits may allow a GBL program to help SWD perform better in school. For SWD, the hands-on component of a GBL program was important. Students stated that they found being in the garden relaxing and being active helped them focus better. Teachers were very enthusiastic about taking their SWD to the garden especially for the science connections. Teachers reported that students who exhibited challenging behaviors in the classroom exhibited fewer of those problems in the garden. More research would help quantify these effects and determine if these effects can carry over into the classroom.

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APPENDICES

Appendix A

Parent/Guardian/Student Informed Consent Agreements

Please read this consent agreement carefully before you decide to allow your child to participate in the study. Your child will also receive an assent form; please review the assent form with your child.

Purpose of the research study: The purpose of the study is to investigate how students with learning challenges learn in a school garden. Little research has been done on this topic and this study will help inform educators as to how school gardens can better help students with disabilities be successful in school.

What your child will do in the study: If your child participates in the study, his or her experience in using the school garden will first be surveyed. If your student has less than one year of experience learning in the school garden then they will not participate further in the study. If they have more than one year's experience in the garden then they may be interviewed about their garden experiences, and observed as they use the school garden with their class. If they are not interviewed then they may be asked to complete a short survey about their garden experiences. If your child is asked to be interviewed or to complete a survey, they will have the option to skip any questions and to stop answering questions at any time. The interview may take 15-20 minutes and the survey 10-15 minutes.

Risks: There are no anticipated risks in this study. The only expected negative is the loss of class time mentioned in the previous section.

Benefits: There are no direct benefits for you or your child for participating in this study. This study may help educators make better decisions regarding using school gardens to help students learn better in the future.

Confidentiality: Once the initial survey concerning your student's experience learning in the school garden is conducted and the participants in the study chosen (subject to parental and student consent), your child will only be identified by a code number or false name in the data. This will apply to data collected via interviews, observations and surveys. A master list of names and code numbers will be kept only by the lead researcher. A false name for your student and the school will be used in any reports or articles generated from the data. Audio recordings of the interviews will be transcribed by either the lead researcher or a professional transcriber, but only the lead researcher will keep copies of the recordings.

Voluntary participation: Your child's participation is entirely voluntary. Participation in this study will not affect your child's grades in any way.

Right to withdraw from the study: You have the right to withdraw your child from the study without penalty at any time. If such a decision is made, any audio recordings of your student will be destroyed immediately. You may withdraw your student by contacting Michael Barrett at mbarret2@ncsu.edu

For questions about his study: Contact Michael Barrett at mbarret2@ncsu.edu, 336 504 5942

Or his faculty advisor Dr. Edward Sabornie at edward_sabornie@ncsu.edu 919 515 1777

Agreement:

I agree to allow my child to participate in the research study described above.

Parent Signature: ___________________________________ Date: _____________

You will receive a copy of this form for your records

Minor Informed Assent Agreement
Please read this paper with your Mom or Dad.

We want to learn about how school gardens can help students learn better and be healthier. You can be a part of this study if you wish.

As part of our study you will fill out a short survey to find out how much you have used the school garden. Depending on the results of the survey, you may or may not be asked to participate further in the study. If you are chosen for further participation, you may be selected for a 15-20 minute interview about your use of the school garden. The interview will be recorded. You may be observed while you use the garden with your class. You may be asked to complete a short survey about your garden experience which will take about 10-15 minutes.

Being in this study will bring you no harm. Using the school garden and telling about how you use the garden are safe activities. The only thing is that you may miss class for 30 minutes or so if you are asked to take the second survey or give an interview. Being in the study will not help you, but it may help teachers to know how to help students learn better.

Your answers to the questions and your actions if you are observed will be kept private. Your name will not be used in any reports that get written about the research. You will be given either a number or a fake name for the interviews, observations and second survey. Only the main researcher will be able to tell which student the research information is about.

You do not have to participate in this study. Your grades will not be affected.

If you start off being the study, you can change your mind at any time and stop your participation. There is no penalty for stopping your part in the study. We will destroy any information we have that involves you.

You can stop your participation by contacting (or having your parents contact):
Michael Barrett
mbarret2@ncsu.edu
336 504 5942

Agreement:
I agree to participate in the research study described above.

Signature: ____ Date: _____________

You will receive a copy of this form for your records.

Appendix B

Teacher Informed Consent Agreement

Please read this consent agreement carefully before you decide to participate in the study.

Purpose of the research study: The purpose of the study is to investigate how students with learning challenges learn in a school garden. Little research has been done on this topic and this study will help inform educators as to how school gardens can better help students with disabilities be successful in school.

What you will do in the study: If you participate in the study you may be asked to be interviewed or you may be asked to take an online survey. Both the survey and the interview will focus on how students with disabilities operate in the school garden. You may also be asked some background questions pertaining to your outlook on school gardens and your professional experience. Though students will be observed in the garden, teachers will not be the focus of the observations. If you are interviewed or asked to complete a survey, you will have the option to skip any questions and to stop answering questions at any time. The interview may take 15-20 minutes and the survey 10-15 minutes. Care will be taken to minimize the impact on your school day.

Risks: The study presents minimal risk to the participants. Care will be taken to minimize the loss of class time.

Benefits/Compensation: There are no direct benefits for you for participating in this study. This study may help educators make better decisions regarding using school gardens to help students learn better in the future. You will not be compensated for participating in the study.

Confidentiality: You will only be identified by a code number or a pseudonym in the data. This will apply to data collected via interviews, observations and surveys. A master list of names and code numbers will be kept only by the lead researcher. A false name for you and the school will be used in any reports or articles generated from the data. Audio recordings of the interviews will be transcribed by either the lead researcher or a professional transcriber, but only the lead researcher will keep copies of the recordings.

Voluntary participation: Your participation is entirely voluntary. Participation in this study will not affect your employment status in any way..

Right to withdraw from the study: You have the right to withdraw from the study without penalty at any time. If such a decision is made, any audio recordings of you will be destroyed immediately. You may withdraw from the study by contacting Michael Barrett, the lead researcher.

For questions about his study: Contact the lead researcher, Michael Barrett at mbarret2@ncsu.edu 336 504 5942
or his faculty advisor, Dr. Edward Sabornie at edward_sabornie@ncsu.edu 919 515 1777

Please feel free to contact the NCSU IRB Office via email at irb-director@ncsu.edu or via phone at 1.919.515.4514 if you feel you have not been treated according to the information in this form, or your rights as a participant in research have been violated during the course of this research study.

Agreement:

I agree to participate in the research study described above.

Signature: _______________________________________ Date: ____________

You will receive a copy of this form for your records

Appendix C

Interview Questions – Students

You chose _________ and ___________ as your 2 favorite classes. What is it about those classes that you like?

You chose ________and __________ as your 2 favorite places to learn at school. What is it about those places that make them a good place to learn?

What do your teachers do to make those places good places to learn?

Do you like being outdoors?

What outdoor activities do you do?

You mentioned the school garden as a good place to learn, how many years have you helped in the school garden?

Do you garden at home?

What have you learned in the SG?

(If a positive response to the previous question) How did the SG help you learn?

How do you feel when you are in a SG?

What is your favorite SG story?

Do you eat any new foods because of SG?

If possible, how could the school garden be better?

Do you have any questions for me?

Thank you for your time and participation.

Appendix D

Interview Questions – Teachers

How many years have you taught at Oakdale? … and how many years have you used the school garden?

What are your reasons for signing up to use the garden?

What subjects do you emphasize in your garden visits?

How does the school garden help students, particularly SWD, learn the curriculum?

How involved are your students in the development and ongoing care of the garden?

Have you ever taken SWD to the garden? How did he/she do?

What impacts regarding SWD are you aware of?

Have you noticed any differences in SWD behavior associated with the garden?

When you take your class to the garden, how do you differentiate for SWD?

If possible, how could the gardening experience for SWD be improved?

What are the negative aspects of taking SWD to the garden?

What would you tell a teacher new to Oakdale about the garden?

Do you have any questions for me?

Thank you for your time and participation.

Appendix E

Observation Data Recording Template

Date: _________________ Place: ___________________________

Research question____

	Observation	Inference
Time		

Appendix F

Categories and Initial Codes

StuDo (categories in bold) – student responses, *teacher responses,* observation initial codes

What is your favorite garden story? planting and pulling out weeds (student response)

And also we had to count the numbers of the bugs we found.

And not fidget with pencils and anything

And you've helped in the garden for six years.

Do you fidget when you're in the garden? A: No, because I'm usually at work with something. I only do that when I'm bored.

[what have you tried?] Eggplant, squash, green beans, tomatoes

[what have you tasted?] Eggplant.

Have you tried any of the foods from the garden? A: They were awesome.

I do like to dig, harvest stuff

I do like watching ants. I think they are interesting

I especially like to help out in the garden because I used to have a garden in my backyard

I have eaten sweet potatoes, squash, green beans. Surprisingly though we did not eat apples. Potatoes

I have never tried squash until I tried it here and I love it now

I have raked leaves, put down mulch, dug potatoes.

I helped plant a cherry tomato.

I know their (sic) harvest popcorn

I like getting the school food. It's better than cafeteria food

I like when we did the mosaics at home and then we put then in our school garden

If it's involved with my hands I do usually do it.

It did get some of my energy and stuff out so I could actually focus better.

One year we counted the number of plants.

Planting.

So sometimes like there would be old plants that are about to die so we would kind of like she would tell us the plants we need to pick so it can grow new ones kind of.

So you said you've helped in the garden for four years.

Students in my class will go out each month to either help with garden jobs or observe science objectives.

Uses hand sanitizer and puts away gloves = Still following directions. He knows the routine

We got to pick the strawberries and after that we got to eat the strawberries.

We picked it up and there was a pile of worms under it. It was really cool but it was kind of weird.

Yes, you can look at food

You help nature

You plant seeds

You water them and make sure they get enough sunlight.

and because I get to plant things.

finds pieces of squash

have planted some stuff and I have picked -- pulled weeds

l planted carrot seeds and pulled out weeds

she would tell us the plants we need to pick so it can grow new ones kind of.

sometimes there will be like different kinds of spiders and stuff and I like to see where they like to go.

teacher took us out to the garden to water plants and to I got put picking strawberries.

there was a bird nest near the school garden with eggs in it, and we got to watch it from the TV.

they will take samples out of the garden and bring it to the classroom so we can try the samples.

they'll let you plant stuff and kind of explore and I like that.

those kids are the ones that are responsible for watering it and frequently throughout the day we give them cups, they put the dirt in, they put the seeds in, they water their little cup and it goes in the greenhouse

we went to check out all the bugs

we were like doing research stuff

what you do in the garden is you rake leaves, you put mulch, you water the plants.

We talk about being scientists and how we as young learners are scientists and what do we use, our five senses, what do we hear when we're out in the garden, what do we see, what do things feel like and so it correlates strongly with our science unit. (teacher response)

1002 looks at a girl, comparing, looks at a sweet potato. He is slowing down with the weeding but is doing well enough. He reaches far into the bed … stuffs weeds into a bag = Seems to like digging in the dirt. (Observation initial code)

1002 notices that another student has found a sweet pot. and he starts digging. = 1002 gets into the task of digging for sweet potatoes. He seems to be enjoying it.

1014 redirects his partner who was distracted. = Shows good leadership and teamwork and perhaps an understanding of the other student's limitations

1014 says, " I need more work in the garden" = He is enjoying the time in the garden. Feels good about his work.

Students are to look for sweet potatoes. 1002 is looking at a sign, not attending to the teacher's instructions = Distracted

Moves corn plant to keep it from being damaged. Moves deeper into weeds. = Shows care, still focused. Wants to do a good job.

the task shifts to weeding. 1002 is weeding while being social

is looking out for his partner showing care and compassion

is weeding well with appropriate social interactions

Follows directions. He dumps his bucket. = He is a good worker

His partner has wandered off. 1014 is still weeding, focused. = His distracted partner did not distract him. The job may have priority over keeping up with the other student.

StuFeel (categories in bold) – student responses, *teacher responses*, observation initial codes

I feel happy. (student response)

It's like gardens and like dirt are my happy places.

It's calm. I do like animals and stuff

And you're not bored when you're in the garden? A: Nope.

It's my happy place. –

I had a lot of fun with it and I just think it's awesome.

… because I like to learn about plants. They're interesting

Scared and weird. A little scared and itchy a lot but it's worth it.

So I don't like snakes or bugs but I don't mind them. As long as they don't get near me I'm fine.

I don't like getting that dirty

like being in the garden because of snakes … because they're cute.

I'm afraid of being stung by a bee.

… and also my favorite food in the garden was strawberries

Do you have any favorite foods from the garden? A: Tomatoes.

The most interesting story I've ever had is when the snake somehow was climbing up that.

We picked it up and there was a pile of worms under it. It was really cool but it was kind of weird.

It feels   it's hard to explain. It's a really good feeling.

It reminds me of putting my feet up on my desk. It's relaxing.

It's kind of like super quiet but there's really like nature songs. It's kind of peaceful.

… because it is hard work

How do you feel when you are in the school garden? “A bit happy and a bit tired.”

You did not mention the garden as a favorite place to learn. Why not? “It takes a long time.”

I like to learn about plants. I think it's interesting and fun.

they'll come in ecstatic (teacher response)

1014 says, “ I need more work in the garden” = He is enjoying the time in the garden. Feels good about his work. (observation initial code)

Says, “My arms are itchy,” = He was willing to put up with a little discomfort to get work done and help in the garden.

He is having a good time. Seems happy

StuLearn (categories in bold) – student responses, *teacher responses*, observation initial codes

Did you learn any school subjects in the garden?   A2: No. (student responses)

: No?

I also know there's caterpillars, butterflies in the garden. & A lot of crawly animals & snakes. & Spiders. & There's a lot. Crickets

I like to learn about plants.

then the teacher will kind of like tell us about it and I think that's really cool because I like to learn about plants

we learn kind of like the water cycle and she said something about the garden with it, how like it rains and like that kind of stuff.

We made an eco-colony.

They use tomatoes and maybe peppers in salsa I think.

they told me that if you leave the weeds out, they will regrow again so you have to take the weeds out of the ground.

bugs cause disease and stuff for plants.

“ … if you just dump it like that, like a cup of water, it's gone.   Q: Oh, so you have to be careful. . . A: Like pumpkin plants and melon plants.

you have to water them a lot. So I was interested how that did that much water. I've never had a plant do that.

How to take care of the plants.

Have you done any subject school stuff in the garden? A: No.

: No.

It teaches you about what garden spiders can help the plants.

And that they also have this wheel that you spin and you spin the wheel and then you get a different type of plant and then it talks about the plant. Like there's corn. Like when they do activities, they bring it outside.

How to plant

Does the school garden help you learn? " … caring for plants and learning how to plant."

I like to learn about plants. I think it's interesting and fun.

They see them grow from a seed to full and then in early May

Another student finds a snail. 1002 is curious, still smiling, getting his picture taken = He shows an interest in living things, still enjoying the garden. (observation initial code)

AdvBehav (categories in bold) – student responses, *teacher responses*, observation initial codes

If it's involved with my hands I do usually do it. (student responses)

It did get some of my energy and stuff out so I could actually focus better.

Do you fidget when you're in the garden? A: No, because I'm usually at work with something. I

. And you're not bored when you're in the garden? A: Nope.

their behaviors definitely do change. Their faces light up. You see the smiles. You see the excitement (teacher responses)

kind of gets them more involved with what their classmates are doing or saying.

. I've seen some of my more obnoxious kids or the more outspoken kids kind of shine in an environment like the garden.

I mean we're talking four or five months where the kids are just ecstatic about everything going on out there.

I definitely see with those students a higher engagement versus sitting in a classroom and being easily distracted by a movement in the classroom or somebody saying something or the clicking of a pen where in the garden they're in that environment and I just see that engagement level more with them.

There's less redirection for them to get on task because they're focused. They get hyper focused on it at times.

Sometimes children with behavioral disabilities, somehow the garden kind of magically focuses them *children who are sometimes severe behavioral problems in classrooms, I've never had a problem with them in the garden*

but they're just so engaged and so excited to be there, I've just never had a behavior issue there.

Yes, my students with disabilities were interested and engaged in the garden, for the most part.

They seem excited to be part of the hands-on learning experience.

For some they seem more content and I would say that for most all students they are happy in the garden.

Have certain students work off some energy, something different to do, gets them up and moving, it helps out our school.

Sometimes the students are calmer when going back to the classroom b/c they were able to get some energy out

These students can be more rambunctious because they are able to move around more. If they are given a specific task it usually helps them settle.

is weeding well with appropriate social interactions (observation initial code)

A1014 redirects his partner who was distracted. = Shows good leadership and teamwork and perhaps an understanding of the other student's limitations

asks other students nicely to move so his partner can get past.

Hands bucket to other student. Working well w/ partner. Weeds pulled. = Doing well socially and still getting the job done. 1014 shows care for peers and the garden

1014 says, “ I need more work in the garden” = He is enjoying the time in the garden. Feels good about his work.

His partner has wandered off. 1014 is still weeding, focused. = His distracted partner did not distract him. The job may have priority over keeping up with the other student.

Advises another student to put basket down = Shows leadership, following directions (it was the end of the session)

Says, “My arms are itchy,” = He was willing to put up with a little discomfort to get work done and help in the garden.

Teacher leader is talking …. 1002 is attending, moves closer to speaker, gloves in hand = Student shows interest and focus (S-O-1002)

1002 watches other students weed as he waits for an assignment. He raises his hand … he is holding a big weed. Teacher breaks it up for him. = Initially patient then he is enjoying being productive while interacting with his peers. (S-O-1002)

Still on the job = He is maintaining focus, still attending, enjoying the garden setting

AdvNewFood (categories in bold) – student responses, *teacher responses*, observation initial codes

I liked the cabbage. (student responses)

They were awesome.

especially liked the kale chips because they had a lot of salt on them and that day at school I brought wasabi.

I liked the kale chips and the squash.

what I like is sometimes some of the actual like garden people, they will take samples out of the garden and bring it to the classroom so we can try the samples.

There was once this one, for some reason I think they call it, like it was chips and salsa but I think they got the salsa from the tomatoes in the garden or something. But like yeah, they bring foods from the garden.

A: I have eaten sweet potatoes, squash, green beans.

I have never tried squash until I tried it here and I love it now.

His mom emailed me after a few times of doing it, and she was amazed at the fact that he was coming home and telling her about this vegetable that he just tried or this vegetable that he just tried. (teacher responses)

I hear a little bit of feedback from parents, zucchini, squash, tomatoes, things that a lot of five year olds usually will not try just because of the way it looks. I think it's really helped open up them as far as eaters and some of them say "wow, I liked it"

Eggplant we have kindergarteners tasting that parents never thought they would. Zucchini. .

Sometimes it's raw. Sometimes it's sautéed. The kids love it. Everybody can't wait to try it.

one of the most favorite things that the kids eat every year is baked cabbage and it's surprising because everyone is thinking well cabbage isn't very popular but they love it. It's just all kinds of things. Sometimes we have pickles and salsa and cabbage and eggplant, cucumbers, carrots, rattlesnake pole beans. You name it, we have it and the kids get to taste it. I often get emails from parents asking me how I got them to eat this or that and what was the recipe? (

I know one year I did have somebody who had an aversion to texture and their mom was surprised that they were eating some of the things out of the garden that they would never have eaten at home and I know that that is part of when you are out there growing it and seeing it, it heightens your expectation and kind of excitement towards trying it and they did and they liked it.

AdvNovelExp (categories in bold) – student responses, *teacher responses*, observation initial codes

We got to pick the strawberries and after that we got to eat the strawberries. (student responses)

there was a bird nest near the school garden with eggs in it, and we got to watch it from the TV.

what you do in the garden is you rake leaves, you put mulch, you water the plants.

I have raked leaves, put down mulch, dug potatoes.

You have to water a lot and some plants you have to water them a lot. So I was interested how that did that much water. I've never had a plant do that.

: The most interesting thing that happened to me was when we were like picking this plant that kind of, let's say it died and it wasn't growing any vegetables. We picked it up and there was a pile of worms under it. It was really cool but it was kind of weird.

A: I'll go first. The most interesting story I've ever had is when the snake somehow was climbing up that. Q: Up the fence? A: Yeah. I've always seen snakes on the ground and so I found it slithering up the fence.

I know their (sic) harvest popcorn

say if a bunch of kids are crowded around one little plant bed thing, then the teacher will kind of like tell us about it and I think that's really cool because I like to learn about plants. They're interesting.

They love touching and feeling. We let them touch everything in the garden. We let them freely explore. (teacher responses)

"would you like to put your finger in the dirt to make the hole, that's how we do it" and "no," didn't want anything of that. So, we gave him a Popsicle stick and he's able to do it.

They find all kinds of bugs and they're not fearful either. We've taught them that if you see spiders and if you see things that look like snakes, obviously don't touch but we've gone through all different types of good bugs in the garden, bad bugs in the garden and what do we do and they find earthworms, they find millipedes and I mean they have them in their hands ..

The garden is more hands-on and more engaging than within the classroom and seeing a video or seeing a slideshow.

so they're open to tasting something different and knowing that it's coming from the garden, it's pretty cool.

They get involved in the planting and the harvesting and the weeding and then seeing that food that they picked that day come into the classroom for them to eat.

All of the curriculum elements and the healthy living and community service and it was just fabulous for a well-rounded child.

When I was a child, everybody was outside all the time and it's just not the same for children today and even sometimes there's a big fear of everything outside, spiders and bees and ants, even ants. Every ant is a fire ant even though they're absolutely not. And so I like to take them out and I like them to just wonder and to see things and to wonder what they are and to get excited and they call me over and ask me what this is and we talk about it

We do a lot of talking about it and prepping for it and the students in the garden know that the bees that are in the garden are busy bees and busy bees are not bees that want to bother you. You leave them alone, they leave you alone

A: So I don't like snakes or bugs but I don't mind them. As long as they don't get near me I'm fine. I don't like getting that dirty but I do think it's fun to, you know, sometimes they'll let you plant stuff and kind of explore and I like that.

1014 finds pieces of squash. = Seems interested in garden produce (observation initial codes)

Another student finds a snail. 1002 is curious, still smiling, getting his picture taken = He shows an interest in living things, still enjoying the garden.

AdvFeelgood (categories in bold) – student responses, *teacher responses*, observation initial codes

It feels … it's hard to explain. It's a really good feeling.

It reminds me of putting my feet up on my desk. It's relaxing.

It's kind of like super quiet but there's really like nature songs. It's kind of peaceful

I feel happy.

It's like gardens and like dirt are my happy places. It's calm.

How do you feel when you are in the school garden? a bit happy and a bit tired.

It's my happy place. –

How do you feel in the school garden ? Happy

Then we've seen other young children, when we go out there, they absolutely love it

but then what we harvest is tasted by our school and all of our leftover produce heads to third grade where they weigh it and then we donate it to the local food pantry.

Yes, in the past and this year as well my students with disabilities really enjoy the garden. They like the jobs and there are many ways for them to help.

I feel the garden helps SWD feel successful and even gives them a chance to lead at times.

other than ADHD. These students usually love to work in the garden and get dirty.

1014 says, "I need more work in the garden" = He is enjoying the time in the garden. Feels good about his work

1002 looks at a girl, comparing, looks at a sweet potato. He is slowing down with the weeding but is doing well enough. He reaches far into the bed .. stuffs weeds into a bag = Seems to like digging in the dirt.

AdvLearning (categories in bold) – student responses, *teacher responses*, observation initial codes

then we went to check out all the bugs and we were like doing research stuff.

We were going to do something for our ecosystems but it was raining.

How to take care of the plants.

You water them and make sure they get enough sunlight.

I have raked leaves, put down mulch, dug potatoes.

I mean one time my teacher said something about let's say we learn kind of like the water cycle and she said something about the garden with it, how like it rains and like that kind of stuff.

they also have this wheel that you spin and you spin the wheel and then you get a different type of plant and then it talks about the plant. Like there's corn. Like when they do activities, they bring it outside.

One year we counted the number of plants.

And also we had to count the numbers of the bugs we found.

bugs cause disease and stuff for plants.

The ecosystem.

Yes. Definitely. We made an eco-colony.

They're in charge of their learning. They can freely explore. The garden is very hands-on. I would greatly miss that garden. I mean I've been here a long time and we haven't always had that garden and I really think that it's enriched the learning drastically with kindergarteners.

I think it actually gives them something tangible

I give it to the whole class but the primary for the graphic organizer are for my students of lower needs so they have something to be able to write down and make that connection

is and also a hands-on, eyes on version of the curriculum. They're not just hearing it or reading about it. They're actually seeing, experiencing, touching, feeling. That really helps to accommodate all different kinds of learners.

we all know that the more parts of your brain that you're tapping into, the better the learning and connection it is and that those experiences that you get in the garden are really irreplaceable

It's a hands-on, practical application of learning.

Real world, hands-on experiences

For students the garden is a place where all can feel successful. They can all help with different jobs and in the garden they can share strengths that may not be seen as strongly within the classroom

Hands-on experiences deepen meaning for all students.

They get to do a different type of activity, rather than sit in the classroom. They are moving more instead of being expected to sit still.

(Kindergarten kids) " I want to see what the plants are doing today."

if they are lower in reading or lower in math, ..., that doesn't affect their ability to go and be able to watch, and observe, and to dig, and learn about the garden

... and what makes the vegetables grow really well, ... and just the agriculture that goes with gardening. I think that it's just a very valuable life skill.

But when you're in the garden, it's kind of just an equal ground for everyone.

DisadvCurrDiscon (categories in bold) – student responses, *teacher responses*, observation initial codes

Do you ever do school stuff in the garden? A: No.

: No.

Do you ever do any math activities in the garden? A: Not that I know of.

Do you ever do any math type stuff in the garden, in the school garden? A: No

Did you learn any school subjects in the garden?   A2: No.

A1: No

DisadvNegFeelings (categories in bold) – student responses, *teacher responses*, observation initial codes

Why would you be nervous in the garden? A: I'm afraid of being stung by a bee.

So I don't like snakes or bugs but I don't mind them. As long as they don't get near me I'm fine. I don't like getting that dirty but I do think it's fun to, you know, sometimes they'll let you plant stuff and kind of explore and I like that.

Scared and weird. A little scared and itchy a lot but it's worth it.

You did not mention the garden as a favorite place to learn. Why not? “It takes a long time.”

They can track a lot of dirt into the classroom. Clothes get dirty.

One student whose anxiety related to insects was less engaged but we found a way for him to learn from the experience by watering instead of planting.

you do have the kids that don't want to get dirty, and kind of back away, and just watch and observe.

Some children that have sensitivities to textures,

I have seen a few in kindergarten, they don't like touching the dirt. It doesn't feel good on their hands.

He didn't like the way they felt and I could see that when he would touch these things because he had some sensory struggles, he would get stressed and his hands would flap and so he would just walk around and look.

I had one particular student, it was a struggle out in the garden for him. It was because of his over activeness. It's a wide open space. He would run. He would step into the garden repeatedly because he's not being able to make himself stop and think.

Says, "My arms are itchy," = He was willing to put up with a little discomfort to get work done and help in the garden.

DisadvBarriers (categories in bold) – student responses, *teacher responses*, observation initial codes

Physical barriers: for me [student uses wheelchair], maybe pathways instead of mulch between the garden boxes so I -- it's easier for me to get through instead of getting stuck in the dirt and mulch they have and getting stuck on weeds and bumps

I have not had a student in a wheelchair in my classroom, but I just try and think about how those students would be able to maneuver around the garden, and I don't see that happening.

DisadvHardWork (categories in bold) – student responses, *teacher responses*, observation initial codes

You did not mention the school garden as one of your favorite places to learn. Why not?
A: "… because it is hard work."

CurrScience (categories in bold) – student responses, *teacher responses*, observation initial codes

I mean one time my teacher said something about let's say we learn kind of like the water cycle and she said something about the garden with it, how like it rains and like that kind of stuff.

The ecosystem.

We made an eco-colony.

We were going to do something for our ecosystems but it was raining. . ….

in first or second maybe I think we did like, we went outside a couple of times in the week and then we went to check out all the bugs and we were like doing research stuff.

Our curriculum includes a plants and soils unit and so I do try and relate our science to the garden.

It correlates strongly with our science curriculum. Some of the NC standards that we as educators need to teach children in kindergarten is understanding living things, what the needs are of living things and that includes human beings, animals and plants as well.

It also correlates greatly with our weather unit.

We've also got some other instruments out there that we go out there and look at. We've got rain gauges and the kids are measuring the rain and

We talk about being scientists and how we as young learners are scientists and what do we use, our five senses, what do we hear when we're out in the garden, what do we see, what do things feel like and so it correlates strongly with our science unit.

It's part of our plant unit in very early spring. We plant all the seeds. We have a large greenhouse that's on wheels and I bring it in the classroom and get it ready for all of the other classrooms and we plant tomatoes, peppers. ... but we plant tomatoes, peppers, green peppers, a variety of peppers. We also do we've planted watermelon before, zucchini, squash

finding bugs or what's going on underneath the dirt or how some roots are above, some are below, some of the vegetables we eat are on top, some are below and they find things

Part of our curriculum in science is teaching ecosystems and I like to take the kids to the garden when we're learning about the abiotic and biotic factors that an ecosystem needs in order to survive so we go to the garden and the kids go with the T-chart with abiotic and biotic factors on each side and they have to make identifications of the different organisms and non-organisms in the garden and be able to differentiate between the two.

it was originally created to support our [science] curriculum.

our first grade curriculum is organisms and the needs of living things and we try to tie that in with what we're seeing, why is that creature here, why is that plant here when it's not supposed to be, what is it doing, what is it taking from another plant.

Real world, hands-on experiences to supplement ecosystems unit and life science standards

makes many of our science objectives "come to life"

science (plant life cycles, types of soil, composting)

Students in my class will go out each month to either help with garden jobs or observe science objectives.

ties in with science curriculum

What subjects do you emphasize in your garden visits? Science, social studies, math

Interest in ecology and the plan life cycle beyond what we learned in the classroom

Correlates with our soil and plants unit

What subjects do you emphasize in your garden visits? Science

Teacher mentions bugs, insects, stages of growth, cotton. = Teacher emphasizes curriculum ties in for science and history

CurrMath (categories in bold) – student responses, *teacher responses*, observation initial codes

Do you ever do any math activities in the garden? A: Not that I know of

Do you ever do any math type stuff in the garden, in the school garden? A: No.

One year we counted the number of plants.

math work can also, story problems, word problems can tie into what we're doing in the garden too.

what we harvest is tasted by our school and all of our leftover produce heads to third grade where they weigh it

math (observing plant growth)

What subjects do you emphasize in your garden visits? Science, social studies, math

CurrOther (categories in bold) – student responses, *teacher responses*, observation initial codes

What subjects or topics have you learned out in the school garden? not sure

Do you ever do school stuff in the garden? A: No.

Did you learn any school subjects in the garden?   A2: No.

A: No

… I like when we did the mosaics at home and then we put then in our school garden

I think that it's, like I said before, just a very equal playing round for all students.

We have taken things out in that garden into our classroom and just changed our whole entire curriculum that afternoon because that's what they love. These are such student led activities instead of things that I necessarily have planned so they really do love those experiences

I change the lesson for the day because that right there is the greatest moment for those kids to lead themselves in learning.

All of the curriculum elements and the healthy living and community service

There's also writing. They write about what we're doing in the garden and what they're finding and sometimes that writing

art projects or things that pop up from our experiences in the garden

Sometimes it's more literature based

…. the garden provides them with an instance to have multiple access points to what the curriculum. is and also a hands-on, eyes on version of the curriculum. They're not just hearing it or reading about it. They're actually seeing, experiencing, touching, feeling. That really helps to accommodate all different kinds of learners.

it's a free field trip in your backyard that connects with your curriculum

life skills (cooperation, teamwork)

What subjects do you emphasize in your garden visits? Science, social studies, math

Teacher mentions bugs, insects, stages of growth, cotton. = Teacher emphasizes curriculum ties in for science and history

ImproveGBL-structure (categories in bold) – student responses, *teacher responses*, observation initial codes

maybe pathways instead of mulch between the garden boxes so I -- it's easier for me to get through instead of getting stuck in the dirt and mulch they have and getting stuck on weeds and bumps

Maybe an ant farm or two.

And maybe more colorful artwork

The wood boards that make the garden square. … And some of those are falling off.

I'd want to be able to use a drip irrigation system.

That we've talked about putting in like a rubber sidewalk and such for wheelchair access

I have not had a student in a wheelchair in my classroom, but I just try and think about how those students would be able to maneuver around the garden, and I don't see that happening. wonder if maybe there's some ways that we would be able to incorporate wheelchair-accessible activities within the garden for those students?

ImproveGBL-doing (categories in bold) – student responses, *teacher responses,* observation initial codes

Maybe if   I don't feel like they pay much attention to it because in the morning, I have and I like to just go up there and look at it and I see a lot of weeds in there, some not looking good tomatoes that look old so I think if we could make extra time to go to the garden and fix it then it could probably be a good one.

I think the garden needs more care.

Because the bugs are like overtaking it in the winter.

Even most places don't do it but they've been finding …. bugs cause disease and stuff for plants.

If maybe like more people would help.

"Sine noue creatures" [see more creatures?] (S-S-1014)