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Impact of school gardens on student attitudes and beliefs

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Impact of school gardens on student attitudes and beliefs

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ABSTRACT

Current research on school gardens implies positive changes in student attitudes, however most of this research is focused on how students change their dietary behavior during short-term studies. This study provides baseline data for a long-term survey of student attitudes toward gardening, peer relationships, and students' science efficacy. The population for this study was sixth to ninth grade students at Gifft Hill School, St. John, USVI. This school is participating in a five year school garden implementation program associated with the Department of Horticulture at Iowa State University. While the population is limited (N= 40), the implications of a long-term school garden program for middle school students could add significant data to the research available for student attitudes toward school gardens and the impact gardens have on science achievement.

The participants in this study were confident in their ability to complete the science tasks presented in each grades respective science class. Students were also able to recognize the importance of maintaining plant health in the school garden. New students and returning students differed in the degree to which they believe they had the ability to grow and maintain a garden as adults; however they appear to be developing positive attitudes toward consuming fruits and vegetables from their school garden. The baseline data presented in this study will be used for comparison of future student responses to aid Gifft Hill School and Iowa State University with the implementation of this school garden program.

CHAPTER I: INTRODUCTION

School gardens have been associated with American schools since the late 1800s. World War I initiated victory gardens as an outlet for American youth to support their country though food production. Again, during World War II, school children observed their patriotic duty by reviving victory gardens (Halpern, 2002). In addition to the patriotism that was reflected through victory gardens, school children learned about agriculture through experiential learning in a garden setting (Hayden-Smith, 2010). Horticulture societies and garden associations were interested in school gardens for the purpose of keeping the cities attractive while others worked to create school gardens to foster a love for nature (Subramaniam, 2002; Trelstad, 1997). When communities noticed a positive change in behavior of the youth involved in school gardens, professionals and organizations became increasingly supportive of school gardens (Lawson, 2005).

The focus of school gardens has shifted in purpose from production, patriotism, and safety to health and nutrition. Health and school officials see the school classroom and the lunchroom as liaisons for garden nutrition programs. Hands-on nutrition programs based on the use of gardens increased the number of fruits and vegetables children eat on a daily basis, particularly as healthy snack choices (Lineberger & Zajicek, 2000; Koch, Lineberger, & Zajicek, 2005). The more students know about fruits and vegetables from gardening, the more positive their outlook tends to be and can impact their desire to learn and keep positive attitudes in school (Lautenschlager & Smith, 2008).

Teachers who use school gardens in a more specific subject-based approach have helped students improve science and math scores (Klemmer, Waliczek, & Zajicek, 2005; Waliczek, Bradley, & Zajicek, 2001) and have helped students develop positive attitudes toward the environment (Smith & Motsenbocker, 2005). Knowing that schools throughout the country and around the world are having success with school gardens, teachers concerned about the environment and about their students' wellbeing are interested in incorporating gardens into their current curriculum. In particular, teachers at Gifft Hill School have started using a garden during science class to familiarize students with the plants in their environment.

Gifft Hill School (GHS) is located on the island of St. John in the United States Virgin Islands (USVI). To understand the community at Gifft Hill School, sociodemographic information for the general USVI population was collected from the 2000 Census of Population and Housing (U.S. Census Bureau, 2003). The census reported 108,612 total residents in the U.S. Virgin Islands. St. John, one of four islands that make up the U.S. Virgin Islands, hosts 4,197 residents. Overall, 76% of the total USVI population is black and 13% is white (U.S. Census Bureau, 2003). Most of the residents speak English (74%) while Spanish or Spanish Creole, French or French Creole and a small percent of other languages are also spoken (World Factbook, 2011).

The USVI child and youth population (birth to eighteen years) is 24% of the total population, while the child and youth population of St. John is only 4% of the total child population. In 2008 the child population by race was: white, 5%; black, 80.5%; and other, 14.6% (Community Foundation of the Virgin Islands, 2010). Of the total Virgin Island child population, 55.6% live in a single parent home, which is much higher than the U.S. national average of 32%. According to the U.S.V.I. Kids Count Data Book (CFVI, 2010) family structure in the Virgin Islands has changed considerably since 1990; the number of single-mother homes has increased from 33% to 40% and the number of children living with two married parents has decreased from 43% to 33%. The U.S. national average for children living with two married parents is 68% by comparison. The number of children with no parents has decreased, while the number of children living with a single father has increased.

The Virgin Island Department of Education uses the *Virgin Islands Territorial Assessment of Learning* (VITAL) for academic performance assessment, as part of the *No Child Left Behind Act of 2001*. For the 2008-2009 school year, Adequate Yearly Progress (AYP) marks were set for fifth, seventh, and eleventh grades in reading and math. A record of ninety-five percent school attendance and ninety-five percent class participation are also included in the AYP markers. The Kids Count Data Book (2010) reports this data from the USVI public schools by location; the locations are St. Croix or St. Thomas/St. John. On the islands of St. Thomas and St. John there are thirteen total elementary schools, three junior high/middle schools, and two high schools. St. Croix hosts ten elementary schools, three junior high/middle schools, and two high schools. These statistics include public schools, while Gifft Hill School is the only private school on St. John as well as the only high school on St. John, and was not included in the collection of this information but is similar in comparing student populations. These statistics represent the alternative education option for students who attend Gifft Hill School.

According to these AYP benchmarks set, none of the six total junior high schools met the set math or reading targets. Seventy-seven percent of the elementary schools on St. Thomas and St. John met the math and reading targets and both high schools on St. Thomas and St. John met the math targets but did not meet reading targets for the year (CFVI, 2010) (see Table 1).

There is an estimated 10% teenage dropout rate for all Virgin Island high schools. Fifteen percent of the sixteen to nineteen year-old population did not attend school and did not work; unemployment rates increased from previous years. U.S. Virgin Island youth have a mere 5.2% rate of obtaining degrees beyond high school (including a Bachelor's degree).

Table 1. Number of public schools that met the Virgin Island Department of Education AYP marks for 2008-2009

	St. Thomas & St. John (# of schools met/# of total schools)	St. Croix (# of schools met/# of total schools)
Elementary Schools	10/13	4/10
Junior High Schools	0/3	0/3
High Schools	2/2	1/2

From the total population of residents age sixteen and older in the US Virgin Islands, 65% were in the labor force, including civilian labor force, employed and unemployed, and in the Armed forces. Thirty-four percent were not in the labor force. Only 6.3% of these workers age sixteen and older work on the island of St. John. The unemployment rate for teenagers ages sixteen to nineteen was 36% in 2008, contributing nine times more unemployed citizens than the adult population. The unemployment rate for young people ages eighteen to twenty-four was 25%, where 64% reported that they did complete high school. The arts, entertainment, recreation, accommodation and food services industry supports 15.8% of the employed population. Other industries supporting more than 10% of the population included: educational, health, and social services; retail trade; public administration; and construction (U.S. Census Bureau, 2003).

Incomes are reported as household and family household; a household includes all people living in the same housing unit who do not have to be related which differs from a family household where there is one or more related members to the householder. Annual household incomes (U.S. Census Bureau, 2003) in the US Virgin Islands range from less than $5,000 to $100,000 or more for the population fifteen years and older. Nearly eighteen percent of households in USVI make less than $5,000. About fourteen percent of family households have less than $5,000 in income. The median household income is $24,704 and the mean household income is $34,991. Five percent of household incomes are between $75,000 and $99,999 and five percent are above $100,000. Family incomes are similar to those of household incomes in the Virgin Islands, including incomes of related family members fifteen years and older living in one household, where a household includes single and unrelated members. The median family income is $28,553 and the mean family income is $39,467 where income per capita is $13,139 per year.

In 1999, the U.S. Census Bureau reported that the poverty status of USVI consisted of 28.7% of families with children below the poverty level and family households below poverty level with no husband present was 44.6%. The housing occupancy in the US Virgin Islands is as follows: 46% of housing units are owner-occupied and 54% are renter-occupied units. Additionally, over half of the housing units receive water only from cisterns, tanks, or drums with no public water system. These socioeconomic statistics are representative of the families who attend Gifft Hill School.

Iowa State University and Gifft Hill School have been working collaboratively over the past year to develop the Education and Resiliency Through Horticulture (EARTH) program at Gifft Hill School, St. John, U.S. Virgin Islands. This program included the establishment and implementation of horticultural, environmental science, and agricultural practices for middle school students attending Gifft Hill School. Following the University semester schedule, two students from Iowa State University participate in a service learning internship at Gifft Hill School. Each semester the interns are expected to create and implement a project related to the EARTH program goals for the school garden. In addition to the individual projects, ISU students are responsible for teaching Gifft Hill School students plant care and maintenance (horticulture) and various other related topics (i.e. entomology, cooking, sustainability) through activities in the garden and trips to agriculture farms and related events. They also maintain Gifft Hill School production grounds for the duration of a minimum of twelve weeks at a time through the program and they assist program coordinators at Gifft Hill School with EARTH program duties.

After one year, six undergraduate students have designed, installed and landscaped a memorial basketball court, an outdoor patio garden, an outdoor classroom, irrigation for the patio garden, created compost bins, planted numerous fruit trees around the perimeter of the school grounds, and designed additional production gardens to be installed in the future. The patio garden has successfully completed one production cycle and middle school students at Gifft Hill School are familiarizing themselves with plants and fresh produce.

Currently the garden is only accessible to middle school students via one garden class per week during a designated class period. Kindergarten and fourth grade students have recently become involved in a once a week gardening class as well. There is not an established outline for the garden program or an integrated curriculum for including and using the school garden in all middle school classrooms nor do any of the teachers access the gardens as part of the school curriculum outside of the EARTH program class period. The program is taught as an additional class for the middle school students throughout the week. It is not taught in conjunction with any of the Gifft Hill middle school courses, however some of the middle school teachers at Gifft Hill School have become actively involved in the students' EARTH activities by participating in the EARTH period with the students and informally integrating it and relating it to classroom activities.

The EARTH program is designed to be a privately funded five-year program between Iowa State University and Gifft Hill School. Coordinators from Iowa State University and Gifft Hill School have provided six overall goals for the purpose of the EARTH program: design, install, and manage attractive landscapes for sustainable food production; integrate hands-on middle school curriculum that includes horticulture and place-based environmental science; provide healthy, locally-grown food to the Gifft Hill School Community; create and utilize outdoor classroom space for students to learn and connect to natural world in a meaningful way; create a positive perception of horticulture and knowledge of food origins and benefits; and integrate Iowa State University interns and Gifft Hill School students in classroom and elective activities (J. Bousselot, personal communication, November 4, 2011).

Faculties from both schools have participated in surveying and preparing the land at Gifft Hill School for horticultural projects. They, however, have not prepared their curriculum to include the new gardens and projects that accompany the garden, nor has education research been implemented to fulfill the six goals, specifically the integration of the curriculum. “There is also a need for more research on the impacts of garden based learning on student academic achievement, environmental attitudes, and self-esteem” (Desmond, Grieshop, & Subramaniam, 2002, p. 41). The collaboration of Iowa State University and Gifft Hill School provides an opportunity to study some of the noted deficiencies of currently available garden research, benefiting both the students at the university and at Gifft Hill School. This study will serve as the first step in a long-term research plan.

Purpose and objectives

The purpose of this research study was to identify the initial beliefs and attitudes of middle school students and self-efficacy toward academic ability. The specific objectives were to:

1. Describe the reported level of student self-efficacy related to academic ability, specifically science.
2. Describe student attitudes toward plants and gardening.
3. Describe student attitudes toward peer and community relationships.
4. Report the demographic characteristics of the middle school student body.

These beliefs and attitude responses reflect the level to which students rate their abilities in school, their beliefs about relationships with their peers and community at school, and how gardening affects them in any of these measures prior to exposure to a formal, integrated horticulture program.

Need for the Study

Current school garden research implies positive changes in students' attitudes in short-term studies. Long-term achievement on students' academic scores and the long-term effects on attitude changes need to be included in garden research. Measuring student attitudes, and specifically student self-efficacy at school, can inform school administrators of the benefits and documented improvements associated with an integrated horticulture program. This information can be used as leverage for fundraising, recruiting, and annual school reports. Creating a tool to measure the changes in students' attitudes will help describe the educational impact of the program.

Implications for Educational Significance

If the long-term results of this study are consistent with the current research on the effects of school gardens on students' behavior and attitudes, this study will contribute a significant amount of information to support the current literature. Phibbs and Relf (2005) found that the problems that most hindered research on school gardens were timing, funding, the number of participants involved, and keeping participants for the duration of the study. Forty percent of the school garden researchers who completed the Phibbs and Relf survey said that they had one year or less to actually complete their research. Long-term research projects were recommended to include sufficient time for planning, execution, and evaluation. A long-term research project, like the one Iowa State

University and Gifft Hill School have proposed, would fulfill some of the needs that researchers have previously indicated.

CHAPTER II: LITERATURE REVIEW

This chapter provides an overview of the literature related to student learning, self-efficacy, and school gardens. Starting with how students learn and social cognitive theory, the first section describes the student learning experience, experiential learning theory, social cognitive theory, and self-regulation. Next, the section on self-efficacy describes academic motivation of middle school students and science self-efficacy. Following self-efficacy is a section on garden-based learning and school gardens. This section includes a history of school gardening, the impact of gardens on nutrition education, the effects of garden programs on science achievement and general student attitudes. Experiential learning and agricultural education are addressed in relation to school gardens and science learning following the school garden section. This chapter concludes with a summary of the literature and the connection between self-efficacy and school gardens for this study.

Student Learning

All students are shaped by their experiences and personal characteristics; these experiences often shape the student's level of academic engagement, while the various aspects of academics shape the student (Reason, Terenzini, & Domingo, 2006). Terenzini and Reason (2005) proposed a conceptual framework that models the collective impact of college experiences on student learning (Figure 1). This model presents multiple sources of influence on a students' first year at college that had previously only been studied individually. Individually, these influences may not be strong predictors of a students' success in college, but collectively these influences can change student learning.

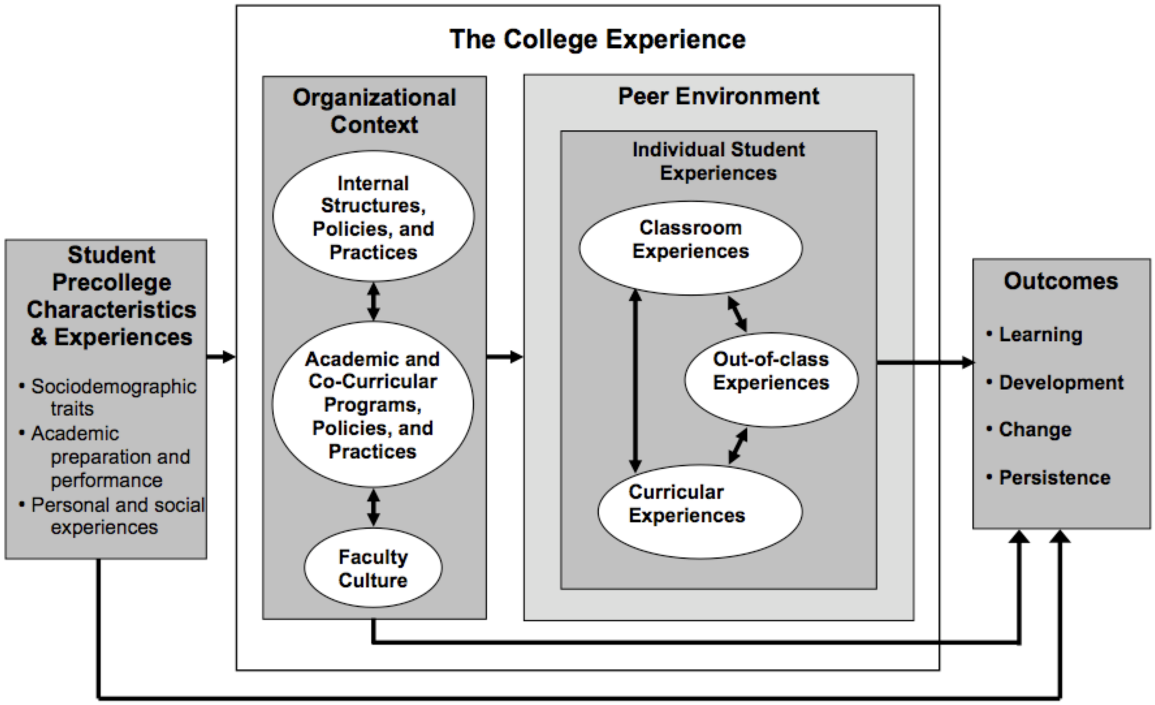

Figure 1. A comprehensive model of influences on student learning and persistence (Terenzini & Reason, 2005).

The model provides a set of student characteristics and experiences obtained prior to the college experience. These inputs include: sociodemographic traits, academic preparation and performance, and personal and social experiences. This particular model includes these inputs to acknowledge the power that individual characteristics have on student outcomes in addition to the whole of the college experience.

The college experience is the main element of this model and it consists of an organizational context, the peer environment, and the individual student experience. These elements, in addition to the precollegiate experience, shape the changes that take place in the student while at college. The organizational context is made up of internal structures, policies and practices; academic and co-curricular programs, policies, and practices; and faculty culture.

The peer environment, including values, expectations, attitudes, and beliefs greatly influence the college experience in many dimensions. Finally, individual student experiences are the most immediate influence on student change and learning. These include academic and non-academic settings including classroom experiences, out-of class experiences, and curricular experiences. This model accounts for how the individual student experiences work together in developing the student. “Together, these dimensions cover a broad array of influences on student experiences and, directly or indirectly, on student learning and change… *multiple forces* operate in *multiple settings* to influence student learning and persistence” (Terenzini & Reason, 2005, p. 5). Following the first year of college, students are evaluated to measure the changes that took place in student learning. Other outcomes that can be measured from the college experience are development, change, and persistence.

This model represents the college experience, however, for practical purposes of describing student outcomes from an academic system, this model will be applied to the EARTH program at Gifft Hill School, in replacement of the college experience. This model is appropriate to represent the influence of the EARTH program on students’ attitudes toward gardening, peer relationships, and science self-efficacy because student characteristics, organizational context, peer environment, and individual student experiences are all present at Gifft Hill School and in the EARTH program.

Even at the middle school level, students arrive with social and academic experiences. Gifft Hill School has apparent structures, policies, programs, and a faculty culture in place. Peer environment and individual student experiences are also consistent with the Terenzini and Reason model of the college experience, but at a middle school level. The outcomes of the middle school experience are also learning, development, change, and persistence of students.

In addition to the inputs of student learning, The National Research Council has outlined three principles to student learning. First, students come to school with many preconceptions (Donovan & Bradsford, 2005). These preconceptions are not always factual and are based on experiences in the student's life provided by many sources. Students need to be engaged in new information to grasp a concept otherwise they will ignore the new information provided to them (Donovan & Bradsford, 2005).

The second principle of student learning is building a foundation of factual knowledge (Donovan & Bradsford, 2005). In order for students to learn, the student needs to build a foundation. Understanding the fundamentals prepares students to build a deep understanding of the topic. These facts should be understood in a conceptual framework. The ideas can't be built separately, the ideas have to be stored in an organized way in order for them to be later retrieved and applied (Donovan & Bradsford, 2005).

Finally, students must be able to take control of their own learning. They need to take a metacognitive approach to learning, think about how they will approach their learning experience (Donovan & Bradsford, 2005). Students should be able to determine what learning goals are necessary to succeed and where they are in meeting those goals. Metacognition is "knowledge about knowledge and learning" (Woolfolk, 2010, p.270). Students progress at different rates and levels, but all metacognition involves planning, monitoring, and evaluating. Students who can recognize what to do, how to do it, and when and why they should use particular methods for learning have a metacognitive approach to learning (Woolfolk, 2010).

Experiential Learning

Seaman Knapp wrote “What a man hears, he may doubt; what he sees, he may also doubt, but what he does, he cannot doubt” (International Adult & Continuing Education Hall of Fame, 1997). Learning by doing is a common descriptor of experiential learning. Learning by doing, learning in real-life context, learning through projects, and learning by solving problems are what Knobloch (2003) calls the four pillars of experiential learning in agricultural education. These four supporting principles are the philosophies of Seaman Knapp, John Dewey, Rufus Stimson, and William Lancelot, respectively. Contributions of these philosophers, particularly those of Dewey and Stimson, were influenced by the educational and child-centered philosophical work of Pestalozzi, Rousseau, and Frobel (Knobloch, 2003).

The philosophies of these four educators, collectively, have been defined as experiential learning, that is “learning in real-life contexts that involves learners in doing tasks, solving problems, or conducting projects” where “real experience, concrete experience, reflective thinking, observational learning, abstract conceptualization, risk and responsibility, active experimentation, and teacher-as-facilitator” are all present (Knobloch, 2003, p. 26). Unlike other learning theories where behaviors or outcomes are the focus, the learning process is emphasized in experiential learning and experience reforms thoughts from what previous experiences have created, “a holistic integrative perspective on learning that combines experience, perception, cognition, and behavior” (Kolb, 1984, p. 21).

Social Cognitive Theory

Social cognitive theory explains human functioning through what Bandura (1988) describes as a "triadic reciprocal causation" (p. 276) that encompasses the person, the behavior, and the environment. Learning, motivation, and general human functioning are influenced by multiple factors that are both internal and external to an individual. The way tasks are interpreted and personal abilities are assessed by an individual are not isolated factors. Social settings invite feedback from others, intentionally or otherwise; students model behaviors performed by teachers and peers to gain confidence in using the necessary skills to attempt and complete a new task (Bandura, 1988). Personal factors encountered before and during a new task are interpreted and controlled by the individual. Behavior and environmental factors also influence the inputs and outcomes of a task. Developmental appropriateness can affect these factors; if the task is too hard for the student and requires skills the student does not yet possess, success will not be met. These three factors, Bandura's "triad", are depicted equally by Pajares (2002) in Figure 2, but the impact of each factor is not always equal in its reception. Dependent upon every occurrence, this triad of factors is weighted to match the students' self-regulation abilities.

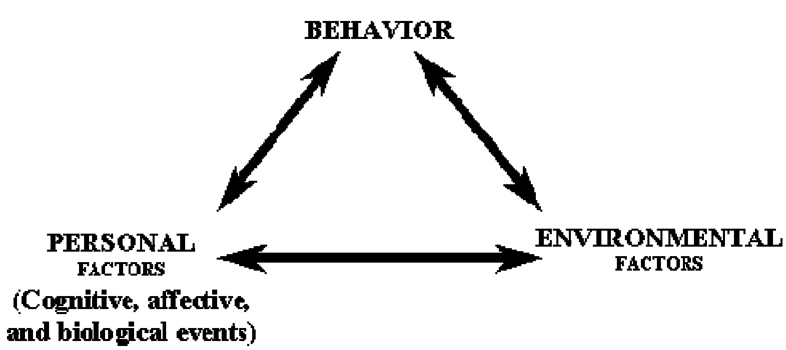

Figure 2. Pajares (2002) Social Cognitive Theory factors.

The influence of these three factors differs depending upon the situation and the individual. Knowing this relationship, teachers can better understand the differences among the students within their classroom. In a classroom, the behavior or task at hand, and the environment are the same but the outcomes vary due to the differences in personal factors. Each individual is responsible for his or her self-regulation in the classroom; students are not solely a product of their environment, "they make causal contribution to their own motivation and action" (Bandura, 1988, p. 1175). Each student will be motivated by different factors and at different levels; students will not take the same actions as their peers to reach their individual goals and, similarly, goals will not be set as high as or as low as the student sitting in the next desk.

Self-efficacy and cognition are two important aspects of social cognitive theory. Motivation and thinking through cognitive processes are highlighted by the uniqueness of an individual's efficacy; high efficacy results in positive cognitive processes and high goals result in high motivation to achieve these goals. Self-efficacy has a particular impact on academic learning and motivation that goes beyond a triangle of influences. It is important to note that through social cognitive theory and self-efficacy, learning becomes a complicated web of inputs where the output is specific to each individual.

Self-Regulation

Self-regulated learning is the use of motivation, metacognition, and behavior to guide learning (Zimmerman, 1990). Self-regulated learners actively seek out the information needed to succeed. These learners are aware of their abilities and thought processes, which allow them to find new ways to study, get advice, and acquire information. This process is what Zimmerman (1990) refers to as a metacognitive function of a self-regulated learner. Pintrich and DeGroot (1990) also refer to metacognitive strategies as a component of self-regulated learning where students are able to plan out the learning process, monitor progress, and modify the plan. Students can respond to the feedback process by changing self-perception or behavior “such as altering the use of a learning strategy” (Zimmerman, 1990, p. 5) to continue learning most effectively.

Another component of self-regulated learning is control over effort, particularly in a classroom task by maintaining concentration and avoiding distraction (Pintrich & DeGroot, 1990). Pintrich and DeGroot (1990) and Zimmerman (1990) include a third feature of self-regulated learning concerning how and why students use the strategies to learn and retain information. These strategies include: organization, rehearsal, and elaboration (Pintrich & DeGroot, 1990), also record keeping, self-consequences, review, and environmental structuring (Zimmerman, 1990). The process of self-regulation takes time and effort so the outcomes must be appealing to students to put in the work, whether it is from a rewards and punishment perspective or self-esteem and self-actualization perspective (Zimmerman, 1990). Whether the results are related to tangible or intangible rewards, some level of motivation is required to be self-regulating.

Three components of motivation related to self-regulation include an expectancy component, a value component, and an affective component (Pintrich & DeGroot, 1990) where students are motivated to self-regulate learning by their belief in ability, the value of the task, and the emotional reaction to a task, respectively. For seventh grade students in science and English classes measured by Pintrich and DeGroot, self-efficacy and self-regulation were positively correlated, as were prior academic achievement and use of self-regulation. Overall, self-regulation was determined to be a better predictor of academic performance than cognitive strategies.

Self-Efficacy

Self-efficacy is the perceived ability held by an individual to perform a particular task (Bandura, 1994). It is a belief constructed by the student about the ability, or inability, to complete a future task. The dimensions of self-efficacy influence an individual's motivation, behaviors, thoughts, and feelings. Individuals with a sense of high self-efficacy set high goals for the future and approach them with confidence. When facing a difficult task, efficacious people are not likely to judge failure as a personal deficiency. Individuals with low self-efficacy approach situations with little confidence and set low, if any, goals to strive toward. These people suffer from stressors related to their belief in a personal deficiency (Bandura, 1977; Bandura, 1994; Schunk, 1991).

Bandura (1977; 1994) provides four sources of influence on self-efficacy: mastery experience, vicarious experience, social persuasion, and physiological state. Mastery experiences, sometimes referred to as performance accomplishments, are the most influential factors on self-efficacy. These are the experiences an individual has had that have provided successful, or unsuccessful, outcomes and this is where the individual forms his or her level of efficacy, based on the perceived success of the completed event. The individuals' perception of the event molds the perceived ability for all future and related experiences. If a new experience is interpreted as a failure, similar events will be difficult to overcome. Usher and Pajares (2006) found that "mastery experience was the more powerful source" (p. 135) of the four and strongly predicted academic efficacy for middle school students at their given reading level. Self-efficacy of students below reading level was not strongly influenced by mastery experiences, maybe because of a lack of mastery experience. Students with repeated experiences are more familiar with academic subjects and are more likely to judge their abilities by these experiences than others with little or no experience in the subject. Repeating a task over a period of time provides students with the experience and the opportunities to develop positive self-efficacy beliefs.

Vicarious experiences provided by a social model are worthy representations for new experiences. When people see others similar to themselves performing a task successfully, it reduces the stress and increases the likelihood that an individual with low self-efficacy will attempt the task and succeed (Bandura, 1977; Schunk, 1991). Peers are particularly good role models for vicarious experience; the more alike the model is to the individual (age, grade level, sociodemographic characteristics), the more the individual will compare and relate to the model; thus, the more likely a student would be to complete a task if peers are successful and relatable.

Social persuasion is presented as words of encouragement and verbal coaxing. Much like vicarious experiences, social persuasion relies on a peer group or external factor. Reassurance gives students the temporary confidence to attempt a new activity or a previously failed activity with encouragement and support. When a supporter conveys external feedback, the individual temporarily feels efficacious which can lead to the development of skills that build stronger self-efficacy (Bandura, 1994). Vicarious experiences and social persuasion are particularly important in classrooms for building academically efficacious classrooms; students rely on peers and teachers to provide support and encouragement when attempting new or difficult tasks.

Emotional responses and physiological states influence the perceived capability to perform a task through physical reactions. Signs of anxiousness, stress, and physical responses (e.g. heart rate) can be interpreted as a lack of ability or skills (Schunk, 1991). Fear and arousal can hinder accomplishments and the individual can continue to raise their own level of fear by focusing on his or her anxiousness and the stress associated with the activity as opposed to the activity itself. Emotional states and physiological responses can change the whole interpretation of a task or experience (Bandura, 1977). For example, students below reading level were strongly influenced by their physiological state when determining their academic efficacy (Usher & Pajares, 2006). Emotional response to a task can override the completion of the task regardless of the rate of success if the emotional reaction was interpreted as scary or undesirable. “Feelings of anxiety toward academic tasks work to undermine students’ beliefs in their academic capability” (Usher & Pajares, 2006, p. 127).

The strength of an individual’s self-efficacy matters; how strong or weak the efficacy level is perceived determines how much effort the student will exert, the emotional reaction one has, and his or her behaviors and thoughts. These factors, or processes, influenced by self-efficacy can inhibit or enhance the extent to which personal goals are set and met (Bandura, 1994). Goals reflect the level of self-efficacy perceived; the higher one’s self-efficacy, the higher and more challenging the goals (Bandura, 1994). Goals also affect motivation; individuals lacking self-efficacy are likely to be less motivated to accomplish goals, even the goals they are capable of attaining (Schunk, 1991).

The influence goals have on motivation vary by the perceived attainability. Performing tasks directed toward goal attainment likely develop the skills and abilities that enhance self-efficacy, but if the goal is not close at hand and doesn't seem realistic, it is less likely achieved (Schunk, 1991). The more motivated and goal-oriented an individual is, the wider his or her self-efficacy range and the more possibilities are considered in education and career choices (Bandura, 1994).

Academic Motivation

Schools are a combination of environment, personal, and behavioral factors that are constantly changing, challenging, and developing goals and efficacy opportunities for students. Many schools allow students to develop a belief about their academic ability but quickly track, reroute, or send students in another direction if the student does not perform at a normal rate or level, regardless of students' perceived academic efficacy. This quickly shapes how students perceive their academic success. Classrooms are socially concentrated and less focused on the student as an individual, altering and usually hindering the scope of academic self-efficacy (Bandura, 1994).

Working in a comparative situation like the classroom, where students are expected to increase what they know, a common student goal becomes increasing competence whether students have high or low academic self-efficacy. Some efficacy might transfer among subjects, but it is likely that the student has to first recognize a shared skill or commonality between subjects (Schunk, 1991). Self-efficacy specific to one subject has a greater influence on student motivation than a general academic self-efficacy (Choi, 2005). Although, a general academic efficacy is more strongly correlated to subject efficacy than efficacy between the subjects themselves (Bong, 2004). A focus on performance-approach and performance-avoidance goal orientation is more generalizable at the academic level and is less subject specific; performance-approach and performance-avoidance goals are focused on competing with peers for the notoriety or performing to avoid failure, neither are specifically focused on learning the material (Bong, 2004).

The effort and persistence that Bandura (1994) discusses as influenced by self-efficacy play an important role in academic motivation. The time and energy and the duration of persistence a student expends on a task is related to the level of self-efficacy of the task and drives students' motivation. "The direct effect indicates that perceived self-efficacy influences students' methods of learning as well as their motivation processes" (Zimmerman, 2000, p. 86). Self-efficacy and motivation help regulate the goals that students set for subject specific tasks and for their general academic abilities. Zimmerman, Bandura, and Martinez-Pons (1992) found that the goals students set for themselves academically are related to the students' perceived academic achievement efficacy and also to the final grade the student receives. This study showed self-efficacy for academic achievement was significantly correlated with grade goals and was also significantly correlated with final grades (Zimmerman et al., 1992). These personal goals were correlated with the student's final grades. Self-efficacy for this set of students was particularly influential on the goals and thus, motivation to do well in social studies. By building academic self-efficacy through parent and teacher support, previous social studies grades, and self-regulation, these students were able to set high goals for a final grade that was well within reach (Zimmerman et al., 1992).

Students with high self-efficacy generally set higher goals with higher returns and believe they have high academic ability; contrary to that, students with low academic self-efficacy believe that they have lesser academic ability and may actually decline in their beliefs of ability and do not set challenging goals for themselves (Choi, 2005). These students at varying levels of ability are motivated by different factors like mastery goals and performance goals, and are building academic efficacy from different factors like mastery experience, physiological state, vicarious experience, and social persuasion. Usher and Pajares (2006) report reading level as a differentiator of sources of efficacy. Students with low reading abilities use their emotional and physiological state to determine self-efficacy level and students who have at or above reading level abilities use their mastery experiences to build self-efficacy. The same study reported a different source of efficacy for boys and girls. Mastery experience is a strong overall source for self-efficacy; however, middle school females tend to rely on feedback and judgment of others as a source of academic efficacy (Usher & Pajares, 2006).

Another factor in determining source of efficacy is race/ethnicity (Usher & Pajares, 2006). Mastery experience and social persuasion are the strongest predictors of self-efficacy for White middle school students. For African American middle school students, social persuasion was the strongest predictor of self-efficacy. Much like female students, social feedback and positive or negative messages received from teachers and parents impacts the degree to which students form their academic efficacies (Usher & Pajares, 2006). The formation of these academic efficacies from various sources influences the degree to which students develop motivational goals for themselves and their learning. Self-efficacy development from adolescence into adulthood prepares students for careers and responsibilities associated with this transition. Students with high self-efficacy in a particular school subject will most likely pursue a future related to what they believe they are best at (Bandura, 1994).

Science Self-Efficacy

Self-efficacy translates to a student's belief in the capability to succeed in academic subjects. This perceived belief, or failure, differs by subject. Students with high science efficacy will pursue related tasks, even if there is a perceived difficulty (Britner & Pajares, 2006). In science, mastery experience is a high predictor of science success. The more successful students are in science, by repetition of high scores or deemed successful events, the more likely students are to have a high self-efficacy for the subject. Achievement and persistence in science can lead to science related careers for students.

Self-efficacy is highly correlated with task goals that students set for themselves to learn and master the material they are covering. Performance goals, values for comparison to others, are less related to self-efficacy (Pajares, Britner, & Valiante, 2000). Students with a realistic view of science and those who are taught to deeply think about science concepts have a higher academic self-efficacy as well as a higher correlation with task goal orientation, or the creation of high achieving mastery experience success (Chen & Pajares, 2010). Encouraging the nature of science in the science classroom and the belief in unfixed and changing scientific knowledge may help students understand the flexibility of knowledge which can also translate to the flexibility of learning; the stronger students' beliefs are about their inability to learn science, the less likely they are to grow and develop their abilities in the classroom (Chen & Pajares, 2010).

While self-efficacy is generally well accepted, there are some researchers who have provided counterarguments to the exclusivity of self-efficacy in explaining behaviors. Some behavior-analytic researchers suggest that in addition to what self-efficacy theory presents, there may be other environmental factors that influence relationships and particular behaviors (Biglan, 1987). Additionally, Hawkins (1995) presents discourse analysis as additional justification to self-efficacy theory to better explain or describe behavior prediction. Bandura (1977) stated that “theoretical perspectives differ in how they view the nature and origins of personal efficacy and the intervening processes by which perceived self-efficacy affects behavior” (p. 203).

Garden-Based Learning

History of School Gardens

School gardens have been representations of nature and education throughout America’s history. They have stood as examples of educational and social philosophies and theories for the betterment of America’s youth; they have been symbols of freedom and the American spirit; they have also been representations of healthy living and healthy learning (Desmond et al., 2002; Halpern, 2002; Hayden-Smith, 2010; Lawson, 2005). The diversity that has followed the purpose for school gardens and garden-based education has been extreme in some cases but it remains the same when the focus is on creating a natural and lasting experience for all students.

School gardening has closely followed changes that have taken place in education reform. The support for environmental education and healthy schools has also aroused interest in school gardens in more recent years (Desmond et al., 2002). Although trends for accepting school gardens seem to be related to the support of Progressive Education, school gardens have a history of being part of a bigger picture in American education.

School gardens and natural learning have a rich history connected to John Amos Comenius, Jean-Jacques Rousseau, Friedrich Froebel, Maria Montessori, John Dewey, and Liberty Hyde Bailey (Subramaniam, 2002; Trelstad, 1997). These educators, as well as many others, have influenced the direction and life of the school garden through the rich philosophies and theories of education. Education of the natural world by being an active participant was emphasized by Comenius, Rousseau, and Froebel. Montessori and Dewey represented philosophers of later years who supported the discovery and freedom of learning in natural settings (Subramaniam, 2002).

The introduction of school gardens from Europe to the United States emerged during the late 19th century. Horticulture societies and garden associations were interested in school gardens for the purpose of keeping the cities attractive (Subramaniam, 2002). Other groups and prominent figures, like Liberty Hyde Bailey, worked to create school gardens in order to instill the love for nature and farm life that many children were losing due to urban growth and development (Trelstad, 1997). Many organizations and professionals supported the establishment of school gardens because of the positive effects they had on civic improvement, education, safety, and social and moral development (Lawson, 2005).

The Nature-Study Movement, supported by Liberty Hyde Bailey and many others, taught the importance of hands-on learning in agriculture through the implementation of school gardens for those youth who were disconnected from the experiences of rural life. The idea behind the Nature-Study Movement was to get students to interact with what they were studying (Stebbins, 1909). Bailey, an educator in horticulture and agriculture, supported the pedagogy of nature-study. He wanted to fulfill the lives of students by introducing them to nature exploration and provide them with relevant activities to understand their environment (Telstad, 1997). John Dewey echoed a similar view, supporting the Nature-Study Movement for a thorough understanding in science and nature (Trelstad, 1997). The Nature-Study Movement appeared around the same time as many after-school programs that supported school gardens in and out of school. These programs familiarized students with gardening and brought students closer to their outdoor environments.

Victory gardens and the formation of the United States School Garden Army during World War I turned land into acres of fruitful production full of lessons of horticulture and beyond. These faithful student workers were learning about responsibility and acquiring a dedication of service to the land, their peers, and their country (Trelstad, 1997). During World War II, after school programs contributed to the war effort by participating in victory gardens again (Halpern, 2002). In addition to the patriotism that was reflected through the victory gardens, school children learned about agriculture through experiential learning in a garden setting (Hayden-Smith, 2010). Both World Wars were high periods of growth for school gardens. School gardens were so well supported in the early 1900s that there were an estimated 75,000 school gardens, which sparked financial support from the United States Bureau of Education’s Division of Home and School Gardening in following years (Lawson, 2005; Jewel, 1907; Trelstad, 1997).

After the boom of school gardens during the war, the rise of the Nature-Study Movement, and the support from many professionals in various organizations, school gardens were able to be successful and retain educational footholds for later decades. Through a history of ups and downs, school gardens have been inspired by war, necessity, education, and beautification.

Garden Education and Nutrition Habits

The use of school gardens as a nutrition education tool is becoming more prevalent with the rising concern for childhood obesity. School gardens are being utilized as a resource for teaching youth about nutrition and healthy lifestyles through fruit and vegetable production, particularly in California with the Garden in Every School initiative (California Department of Education, 2007; Lineberger & Zajicek, 2000; Graham & Zidenberg-Cherr, 2005). The school garden as a resource for nutrition education has led to studies on the effects garden-enhanced programs have on student learning and student attitudes. Many studies thus far focus on the affects of gardening on improved achievement and attitudes toward a food group, such as fruits and vegetables.

The Center for Disease Control reports indicates that childhood obesity has been steadily increasing since 1970. Elementary to high school aged youth have obesity rates upwards of twenty percent (Ogden & Carroll, 2010). Schools are prime locations for noticing the increasing weight trends in youth, as they are also prime locations for educating and assisting youth in healthy decisions via nutrition programs (Centers for Disease Control, 1996). Garden-enhanced nutrition programs in schools that incorporate hands-on garden experience seem to increase the number of fruits and vegetables children eat on a daily basis, particularly in vegetable consumption and healthy snack choices (Lineberger & Zajicek, 2000; Koch et al., 2005).

In two similar studies, Koch et al. (2005) and Lineberger and Zajicek (2000) noticed that gardening programs were able to significantly impact students with lower vegetable preference pre-test scores more so than students with higher vegetable preference pre-test scores. Students with low scores have more room to improve their attitudes about vegetables than students who are already familiar with many vegetables. There is room in school garden literature to examine the possibility of these attitudes transferring to other subjects such as science, math, and language. Lineberger and Zajicek (2000) also commented on the ideal age to implement garden-enhanced learning in order to achieve reliable transformation of attitudes; the younger students are, the more acceptable and flexible they are at accepting school gardens as a new learning resource beyond the classroom.

Student attitudes and self-efficacy were measured before and after exposure to a garden program in a study by Lautenschlager and Smith (2008). They found that students' attitudes before the program affected their post-survey knowledge scores but also that the program affected student attitudes measured in the post-survey. These findings about attitude before and after exposure to a garden-enhanced curriculum with students who have low self-efficacy in the classroom are important and should speak to teachers who have access to school gardens. If attitudes and behaviors can be improved in nutrition programs, attitudes and behaviors can be improved in other areas within the academic curriculum.

Ozer (2007) comments on the importance of nutrition education being extended to families and into the community because students are only at school for part of their week. Extending nutrition education programs into the community is much like the goal of having students take their education home with them. The more parents and the local community support the use of school gardens for education, the more successful they will be and the more positively students will behave toward the use of gardens for learning. Many school gardens require volunteer help, especially during the weeks and months that students are out of school. The garden gives parents a different setting to volunteer their time and support beyond the classroom (Ozer, 2007). Bringing parents and members of the community into the garden creates another way for students to be supported and for the community to support the school.

Science Achievement and Student Attitudes

The research available for changes in science achievement and attitudes from implementation of a garden program is limited. Science is the most common core subject taught in California school gardens as surveyed by Graham and Zidenberg-Cherr (2005). Teachers taught science 65% of the time and nutrition only 47% of the time and yet there is more research about the effects of garden-enhanced nutrition programs than there are results from garden-enhanced science programs. This same survey reports, however, that 53% of teachers find the garden a moderately to very effective tool for teaching science.

Science achievement does improve with garden-enhanced science class exposure. Students in science classes who were given ample time to complete work as part of the garden curriculum had better achievement scores than students who were given little or no time to learn in the garden (Smith & Motsenbocker, 2005). Integrating a gardening program into the curriculum throughout the course of one school year can significantly increase science scores (Klemmer et al., 2005). Knowing that short-term and long-term exposure to garden-based learning in the curriculum increases students' science scores is encouraging for educators. It is also practical to point out from Klemmer et al. (2005) the students in the participating fifth grades earned higher science scores than the two lower grades and a suggestion was that they were more developmentally prepared for the skills required for the science concepts of this garden-based program.

Garden-based learning and garden curriculum is more often than not associated with social cognitive theory. Researchers have measured how attitudes change after being exposed to nutrition programs. The same approach has been taken to assess environmental attitudes. Waliczek et al., (2001) found that schools with a garden program that focused on students learning from the experiences a garden setting provided versus a traditional education setting harbored students with significantly more positive attitudes toward school. Research indicates that female students in a garden program have a significantly more positive attitude than females not involved in a garden program and are also more positive than male students (Waliczek et al., 2001). Speculation is that schools that encourage discovery and exploratory courses help students develop more positive attitudes about their education in a supportive environment where teachers and peers are proactive about gardening.

Attitudes toward the environment are learned at an early age; observation of parents and teachers and participation in environmental stewardship can be seen in children as early as preschool. Musser and Diamond (1999) measured the environmental attitudes of preschoolers to determine the relationship between preschoolers' attitudes and parents' attitudes toward environmental topics. Although the children's attitudes were not significantly correlated to parents' attitudes, children's attitudes were significantly correlated with the environmental activities that children participated in at home. While preschool children may not know where adults stand on environmental topics, they are able to recognize and pick up attitudes based on what activities they participate in as a family, classroom, or community.

The implementation of garden programs has allowed Skelly and Zajicek (1998) to compare environmental attitudes of children in a garden program to children not in a garden program. They found that the implementation of a garden program with structured education significantly influences students' environmental attitudes and that a structured and social experience is necessary in making a difference in student attitudes. Similarly, Waliczek et al. (2001) measured the change in student attitudes toward school and personal relationships. After a five-month period, the garden program had a positive effect on students', particularly female students', attitudes toward school. Robinson and Zajicek (2005) also found that student participation in a yearlong garden program helped students develop and refine teamwork skills, life skills, and self-understanding. Attitudes, as well as the ability to make decisions and communicate, improve with exposure and commitment to long-term garden programs.

Agricultural Education and Experiential Learning

Agricultural education is a discipline that was created by the joining of two important disciplines: education and agriculture. Agricultural education is defined as "the scientific study of the principles and methods of teaching and learning as they pertain to agriculture" (Barrick, 1988, p. 5). Barrick (1988) joined the two disciplines, agriculture and education, to accessibly describe the field of agricultural education. Through studying the teaching and learning methods of topics within agriculture teachers are able to provide the best means from which students develop agricultural knowledge and skills. “Agriculture education encompasses all educational processes, activities and programs associated with (in and about) agriculture” (McCormick, 1988, p. 46). To describe what topics are specifically included in agriculture, McCormick (1988) quotes from the National Academy of Sciences:

> The agricultural sector includes supply and service functions involving agricultural inputs; production of agricultural commodities; processing and distribution of agricultural products; use, conservation, development and management of air, land, and water resources; development and maintenance of rural recreational and aesthetic resources; and related economic, sociological, political, environmental and behavior functions (p. 46).

As a discipline that supports the study of teaching and learning of a diverse and skill-oriented field, it is beneficial for educators to provide learning experiences to students. Experiential learning is often associated with agriculture education in practice and in theory (Roberts, 2006). Educational philosophies, beginning with John Dewey, support experiential learning as a theory; Joplin, Piaget, and Kolb also support models of experiential learning. Roberts (2006) describes most research on experiential learning as the process and not the theory. The research of Kolb, Joplin, Dale and Dewey describe experiential learning as a spiral or cyclic experience containing an initial experience, reflection on the experience, generalization of the experience, and further experimentation using information from the previous experience (Roberts, 2006). This learning process works in agriculture education because it encompasses a continuum of educational settings from formal to informal and agricultural education hosts hands-on projects, laboratories, Supervised Agricultural Experience, internships, and many other interactive and exploratory projects (Roberts, 2006).

Experiences in agricultural education are repetitious and always changing. Kolb (1984) differentiates experiential learning from other learning theories by the "continuously modified by experience" aspect of repeated exposure (p. 28). Experiential learning is often utilized in science-based courses and researchers have found that this method produces students with "dramatically different attitudes toward learning science than their counterparts in the more traditional group" (Mabie & Baker, 1996, p. 2). These students were also more likely to relate science to their daily lives, show an interest in science, and want to participate in science because it is interesting.

Garden-based learning and school gardens share philosophies of learning with experiential learning, environmental awareness, ecological literacy, and agricultural literacy (Subramaniam, 2002). Using natural settings to help students grow and connect with the land is what connects garden-based learning, experiential learning, and agricultural education.

Experiential learning is frequently used in garden-based learning (Lautenschlager & Smith, 2008). Students benefit from the methods of learning that well-constructed garden programs provide. Klemmer et al. (2005) say "Hands-on, constructivist learning serves as the main idea behind school garden programs" (p. 452) and that experiential learning gives students room to improve on science skills. These opportunities, the hands-on, experiential learning processes, are just what agricultural education emphasizes in the study and support of learning and teaching for lifelong skills. "Gardens can serve as living laboratories in which students can see what they are learning and in turn, apply that knowledge to real world situations" (Klemmer et al., 2005, p. 452). School garden curriculum is an ideal setting for experiential learning because students are able to participate in a rigorous hands-on activity (gardening), reflect on the experience and generalize the experience through repeated activities in the garden over a long period of time.

Lautenschlager and Smith (2008) found a moderate increase in knowledge gained from a garden program using experiential learning methods. Students participated in the garden curriculum and had the opportunity to reflect upon the knowledge and experiences in a daily journal. Students gained knowledge on nutrition but more importantly, “youth appeared to be empowered to try new behaviors” (p. 22). Mabie and Baker (1996) tell a similar story: “students participating in the experiential learning activities had greater increases in observational, communication, and comparison science process skills, than did students in the control group” (p. 5). Experiential learning not only serves as a tool for deepening knowledge but also as a way to help students change and develop healthy behaviors and improve on interpersonal and communication skills.

Summary of Literature Research

School gardens support the study of the land through the production of local foods, management of the land, and conservation of those local resources. Students gain practical knowledge as well as lifelong skills by working through a garden curriculum with their mentors and peers. Well-developed garden activities help students foster positive attitudes toward science and build up their science self-efficacy. Garden programs improve student attitudes and positive attitudes help motivate students to do well in academic subjects.

Research on school gardens indicates a positive reaction toward nutrition habits when implemented into the curriculum (Koch et al., 2005; Lineberger & Zajicek, 2000). Research also indicates that students have the ability to change their attitudes through garden programs (Waliczek et al., 2001; Musser & Diamond, 1999; Skelly & Zajicek, 1998). Experiential learning through agricultural education programs is similar to how Bandura (1994), Schunk (1991), and Pajares (2002) describe successful building of self-efficacy and establishment of goals: through high support, repeated exposure, and realistic and relevant experiences.

Activities through long-term garden programs have the possibility of helping students develop a more positive outlook toward school while increasing their academic abilities and life skills. With little research available on long-tern school garden programs, there is a need to measure student attitudes over a period of time. To see academic changes and students develop as a result of a school garden program, researchers need to measure attitudes and academics in relation to the garden program. These changes will not happen immediately with a garden program, so long-range plans need to be established at a participating school to study the effects of an integrated garden program.

CHAPTER III. METHODS

The purpose of this study was to identify the initial beliefs and attitudes of middle school students and self-efficacy toward academic ability. The specific objectives were to:

1. Describe the reported level of student self-efficacy related to academic ability, specifically science.
2. Describe student attitudes toward plants and gardening.
3. Describe student attitudes toward peer and community relationships.
4. Report the demographic characteristics of the middle school student body.

This chapter describes the methods used to develop an instrument, collect, and analyze data. The research design, a description of the participants, a description of the instrument, and a description of the procedures are explained. Reliability and validity are also included in this chapter, along with assumptions and limitations.

Research Design

To capture the level to which middle school students agree or disagree with statements about their behaviors and attitudes, a descriptive survey was used. The survey measured the initial beliefs of students' attitudes toward gardening at the beginning of the semester. A hard copy of the survey was distributed to the students for ease of communication and delivery.

Participants

This study was designed to describe middle school students from an existing school garden program. The program is the Education and Resiliency Through

Horticulture (EARTH) program, a garden program for teaching horticulture to students at Gifft Hill School, St. John, USVI. The population consisted of middle school students at a K-12 private school. For this study, students in grades six, seven, eight, and nine were considered the subjects. The sixth and seventh grade students were included because they have not participated in the existing EARTH program. These students, along with any new students entering the eighth or ninth grades, would provide bias-free baseline data. The eighth and ninth grade students were included in the survey group because of their experience in the EARTH program from the 2010-2011 school year. They were involved with the garden program at varying levels throughout the school year. All students in each of the four grades were considered as potential subjects for this study.

Instrument

A review of the literature revealed few instruments for measuring student attitudes and academic self-efficacy from the impact of a school garden specifically, however, the literature did reveal instruments designed to measure the effects of school gardens on nutrition and dietary attitudes and self-efficacy. Lineberger and Zajicek (2000) found that students changed their attitudes toward vegetables after participating in school garden activities. Lautenschlager and Smith (2008) found that participating in a school garden increased students' self-efficacy and attitudes, where "attitude and self-efficacy and subjective norm were constructs most predictive of the nutrition/gardening knowledge score" (p. 20). The more confident students were in their ability and the more positive their attitude was toward working in the garden, the better their scores were on the garden knowledge portion of the survey.

The survey used for the EARTH program (Appendix A) was adapted, with permission, from Lautenschlager and Smith's (2008) dietary behavior and garden and nutrition knowledge survey. That particular study was similar to the purpose of this study in that the population consisted of multi-ethnic students from ages eight to fifteen who participated in a farm and market project, learning about gardening and cooking, much like the basic components of the EARTH program. The survey focused on attitudes, self-efficacy, and subjective norms and additional nutrition and garden knowledge questions. The attitudes, self-efficacy, and subjective norm questions pertained to gardening and dietary behaviors.

The questions for this study were modified to reflect attitudes about gardening and relationships. Self-efficacy questions reflected student beliefs in his or her ability in the current science class and in gardening, instead of nutrition and dietary self-efficacy.

The instrument was divided into four sections. The first sections, self-efficacy, addressed academic ability in science and ability to garden. Eleven questions were about academic ability, all focused on science achievement. Six additional questions were included under self-efficacy to address gardening efficacy. The second section focused on garden attitudes. There were twenty-four questions about garden attitudes to describe how students responded to statements about garden knowledge and working in the garden. Additionally, students were asked twelve questions about peer and community relationships. These attitude questions reflected how strongly students agreed to the importance of working with peers and their families in and out of the school garden. These questions were formatted using a 4-point Likert-type scale including: Strongly Agree (4), Agree (3), Disagree (2), and Strongly Disagree (1).

The last section included eight demographics questions and student information. Questions regarding the students' prior status in the EARTH program and prior attendance at Gifft Hill School were included to distinguish new and returning students. Questions asking the status of family gardens before and after participating in the program were also included to determine the influence the EARTH program has on gardening beyond the physical boundaries of the school. These questions were formatted as checklists to allow students to check all that apply. The demographics also included in this survey were age, grade, and gender.

Ethnicity was initially considered an important demographic for comparing ethnic gardening differences; Usher and Pajares (2006) note ethnicity as a differentiating factor of self-efficacy and ethnic comparisons could be made in the same way that gender and participation were used in this study. Ethnicity, however, was eliminated upon arrival at the participating school due to the sensitivity and complications of collecting and organizing ethnic identity in the USVI community. Students at Gifft Hill School do not easily identify with U.S. Census ethnicity categories, nor do they easily fit into the ethnicity categories presented on the Iowa Test of Basic Skills. A more in-depth preparation and understanding of USVI ethnicity and race identities is needed before continuing with a statistical comparison for this study.

Additional student information was collected from school administration at Gifft Hill School, including grades from previous science classes. The Iowa Test of Basic Skills (ITBS or Iowa Tests) is a standardized test and the science percentile ranks were collected to be used as a resource for consistent comparisons of science achievement in the future. Collecting existing student records, including ITBS scores, was rationalized in using the scores for a comparison to academic efficacy and other student demographics for comparison.

Validity and Reliability

This section discusses the validity and reliability of the study. Validity and reliability are necessary to ensure the meaningfulness and consistency of measure that an instrument provides (Ary, Jacobs, and Sorensen, 2010). The content of this survey was adopted from survey results published by Lautenschlager and Smith (2008), a review of the literature on school gardens and science self-efficacy of middle school students, and Bandura's (2006) guide for constructing self-efficacy scales. A draft of survey questions was also presented to EARTH program coordinators to verify the appropriateness of program directed questions.

Cronbach's alpha was performed as a post-hoc reliability coefficient test. A coefficient of 0.60 is a moderately reliable coefficient for research purposes (Ary, Jacobs, & Sorensen, 2010). The reliability tests for this study were divided into three constructs: science self-efficacy, garden attitudes, and peer and community relationships. Cronbach's coefficients of reliability were 0.71, 0.82, and 0.54, respectively. These coefficients were similar to the reliability of the adopted study from Lautenschlager and Smith (2008) at 0.65 to 0.92.

Data Collection

The survey materials, including informed consent, parent letter, and the instrument were approved by the Institutional Review Board at Iowa State University on August 19, 2011 (Appendix B) and contained the required information for parents and students to accept or decline participation in the study.

Parents of all students enrolled at Gifft Hill School for the 2011-2012 school year in grades six, seven, eight, and nine were contacted on September 6, 2011 by the EARTH program coordinator via a letter mailed to the parents (Appendix C). Two copies of an informed consent document were attached to the parent letter (Appendix D). Students were to return one document to Gifft Hill School as instructed by the letter and parents were to keep one for their records. By returning the consent form with parent and student signatures, both parties were agreeing to participate in the study. Students were reminded by the EARTH program coordinator to return the consent forms to the school prior to September 12, 2011.

During the week of September 12, 2011, the instrument was distributed to students in the designated science class period. This time period extended from September 13 to September 15, depending upon the pre-arranged class schedule for each participating grade. The instrument was distributed to the participants by the researcher as hard copies. Students were able to make up the survey any day between September 13 and September 15. Out of the 54 students enrolled in grades six, seven, eight, and nine, 40 participated in the survey for a total response rate of 74%.

The second part of the baseline data collected for this study were existing school records for students enrolled at Gifft Hill School. These existing records included Iowa Test of Basic Skills science percentile ranks and relevant science grades. These existing records were obtained from the school administration by requesting scores only; student identifications were not collected as part of these records to be consistent with IRB regulations stated in the informed consent.

Data Analysis

The purpose of this study was to identify the initial beliefs and attitudes of middle school students and self-efficacy toward academic ability. The specific objectives were to:

1. Describe the reported level of student self-efficacy related to academic ability, specifically science.
2. Describe student attitudes toward plants and gardening.
3. Describe student attitudes toward peer and community relationships.
4. Report the demographic characteristics of the middle school student body.

The data collected from the survey and the existing student records obtained from Gifft Hill School administration helped achieve the objectives listed above. The data gathered was coded and entered into an Excel spreadsheet and imported into Statistical Analysis Software (SAS version 9.1 for Windows) to analyze using descriptive statistics including mean, standard deviation, frequency, *t*-tests, and effect size.

To ensure confidentiality and to link the student survey with the individual student records, a coding system was developed. The system did not include student names but included student records and the students' responses from the survey instrument that were loaded into an Excel spreadsheet for analysis. The use of a coding system allowed for transition from the instrument responses to student records, without identifying the participant.

Data to support the first objective was gathered by asking questions about academic ability where students reported their level of self-efficacy for understanding and completing science tasks. Similarly, for objectives two and three students were asked to what level they agreed or disagreed with statements about gardening and relationships at school and at home. These objectives and the corresponding survey questions were analyzed in SAS using descriptive statistics, including mean, standard deviation and frequency tables. The demographics collected from both the survey were also analyzed and frequencies for age, grade, gender, and time at Gifft Hill School were reported.

The questions from each section, excluding the demographic characteristics, were additionally compared by gender and by new and returning students to the EARTH program. Fisher's least significant difference (LSD) test was performed to compare the questions by gender and also by association to the program (new or returning). The means of questions reported by gender and by new or returning students were compared at an alpha level of 0.05. Although these comparisons were made, caution should be taken in interpreting the results of this study. The relatively low number of participants limits the generalizations that can be made about this data.

Responses were also compared for effect size. Cohen's *d* was used to compare gender responses and new student responses for effect using a scale of 0.2 (small), 0.5 (medium), and 0.8 (large) (Cohen, 1988).

Assumptions and Limitations

The major assumption of this study was that students have or will work in the school garden throughout the academic school year and that the data collected was baseline data. By using the current class schedule at Gifft Hill School, it was assumed that all enrolled students in grades six, seven, eight, and nine were included and were equally able to be considered participants, however not all students were present the week the survey was administered (e.g. absent due to family emergency or enrolled only the second semester).

The primary limitation to this study was the number of participants from a small, private school where enrollment varies annually. The survey was also limiting to some students but not others, based on the length of time students have known about or been involved with the school garden. The survey asked students to report their perception of attitudes and beliefs that they hold toward science ability, gardens, and peer and community relationships; because of the timing of the survey, some students may have reflected on previous experience in the school garden, if applicable, which is why it was requested that students included the length of time they have been involved and the depth to which they were involved during previous semesters.

The data collected from this study is only generalizable to this population because of the specificity of the site, population, and current applications of garden activities. However, the procedures and general garden attitude questions could be replicated in similar situations, such as other middle schools with access to a school garden.

CHAPTER IV. FINDINGS

The purpose of this study was to identify the initial beliefs and attitudes of middle school students and the perceived self-efficacy of academic ability. The basis of this study was to collect initial data that would serve as a baseline for a long-term study of integrating school gardens into school curriculum. The findings specific to the objectives detailed in this chapter will be presented by 1) Select demographic characteristics of the middle school student body, 2) Self-efficacy in science, 3) Attitudes toward gardening, and 4) Attitudes toward peer and community relationships.

The data for each objective were analyzed and studied from three perspectives. The first was a general analysis of all student responses, which was presented for each section. Second, the statement responses were analyzed by gender. Finally, a comparison between new EARTH students and returning EARTH students was presented to describe the differences between the two distinct participant groups.

Demographic Characteristics

The demographic characteristics of the middle school student body presented in this section were collected from the EARTH survey. These questions provided general information to describe the typical student at Gifft Hill School. The students provided information that reflected their level of involvement with the EARTH program, existence of a home garden before and after joining the EARTH program, number of years at Gifft Hill School, location of previous schools, grade, and gender.

Previous Involvement with EARTH

Students were asked to respond to the statement *I am a new student to GHS this year and did not participate in the EARTH program last year or I was a student at GHS last year and I did participate in the EARTH program last year.* Fifty-five percent (*n*= 21) of the students who answered this questioned had participated in the previous year's EARTH program. Of the seventeen (45%) who said they were new to Gifft Hill School or to the program, eight (21%) said they had been at Gifft Hill School previously. The remaining nine students (24%) who said they were new to the EARTH program were not new to Gifft Hill School (Table 2).

Table 2. Frequency and percent of new and returning students to the EARTH program *(N= 40)*

Student Involvement	Frequency	Percentage
Returning to GHS and to the EARTH program	21	55
Returning to GHS and new to the EARTH program	9	24
New to GHS and new to the EARTH program	8	21

Students who responded to the statement *I was a student at GHS last year and I did participate in the EARTH program last year* were also asked to determine their previous level of involvement with the program. There were three possible levels of involvement for students who participated in the EARTH program from the previous year; students were able to check more than one answer (Table 3).

Table 3. Frequency and percent of returning student involvement in the EARTH program *(n= 21)*

Student Involvement	Frequency	Percentage
Participated in class activities	19	49
Participated in outreach activities	13	33
Volunteered time	6	15

Completing classroom garden activities assigned by the teacher was the first choice, followed by participating in outreach activities with the school (i.e. Earth Day, Ag

Market Day, and VISFI) and finally volunteering during after-school hours in the garden for maintenance (i.e. general plant care and maintenance). Although the assigned classroom activities were part of the required EARTH class participation, only half (49%) of the students who said they were part of the EARTH program claimed to have participated in classroom activities (*n*= 19). One-third (*n*= 13) of the EARTH students participated in outreach activities last year, while 6 students (15%) volunteered their out-of-class time to work in the garden.

Home Gardens

Of the total respondents, more than two-thirds (*n*= 29) of the students at Gifft Hill School had a garden at home before participating in the EARTH program garden. The students were also asked to report if they or their family had started a garden since becoming involved with the school garden and 5% (*n*= 2) said yes. More females responded positively to having a garden at home before working in the school garden than males. Sixteen females (76%) and 13 males (68%) had a garden at home prior to their involvement in the EARTH program.

New EARTH students were also more likely to have had a garden before joining the EARTH program. Eighty-eight percent (*n*= 15) of new EARTH students had a garden before joining the program; this included all but two of the new students to the EARTH program. Of the returning students, twelve students, or 57%, had a garden before joining EARTH and nine students did not. New students were significantly more likely to have had a home garden before starting the EARTH program than returning students (*p*= 0.036).

Grade Level and Gender

Participating students have attended Gifft Hill School between 0 and 13 years (Figure 3). The most frequent student responses were 0 years (*n*= 8; 21%), 3 years (*n*= 6; 16%), 4 years (*n*= 6; 16%), and 9 years (*n*= 7; 18%). The mean number of years of attending Gifft Hill School was 4.5 years, with a standard deviation of 3.6. Students were also asked to locate where they had previously attended school. Only one student was homeschooled prior to attending Gifft Hill School, while 27.5% (*n*= 11) said they had only attended Gifft Hill School, 22.5% (*n*= 9) attended schools stateside, 22.5% (*n*= 9) attended another private school on the islands, and 35% (*n*= 14) previously attended a public school on the islands.

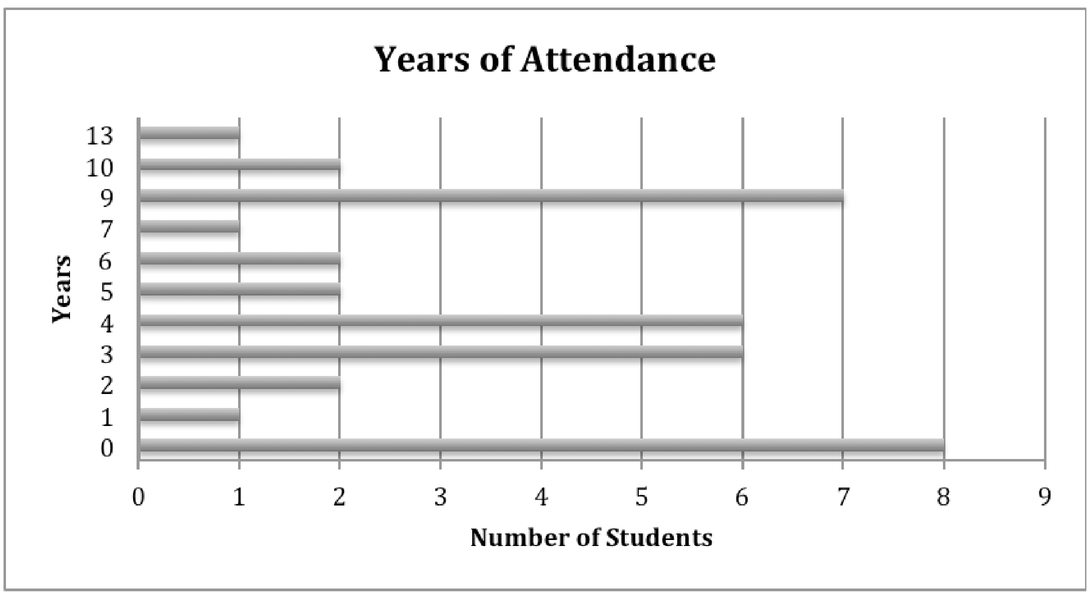

Figure 3. Years of attendance at Gifft Hill School *(N= 40).*

The selected participants for this study ranged from sixth to ninth grade students attending Gifft Hill School. The participants were generally evenly distributed among the four grades, however, the majority of the students (30%) were in the seventh grade (*n*= 12) and ninth grade had the fewest participants (*n*=

7; 17.5%) (Figure 4). There were 11 sixth graders (27.5%) and 10 eighth graders (25%). There were more females than males with 21 (52.5%) and 19 (47.5%) participants, respectively (Figure 5).

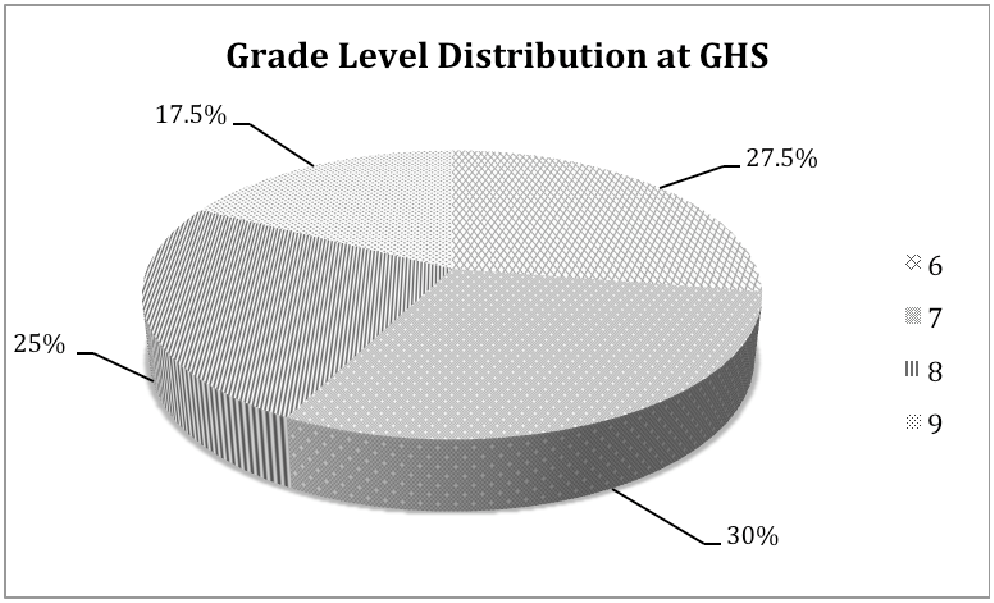

Figure 4. Grade level distribution at Gifft Hill School *(N= 40).*

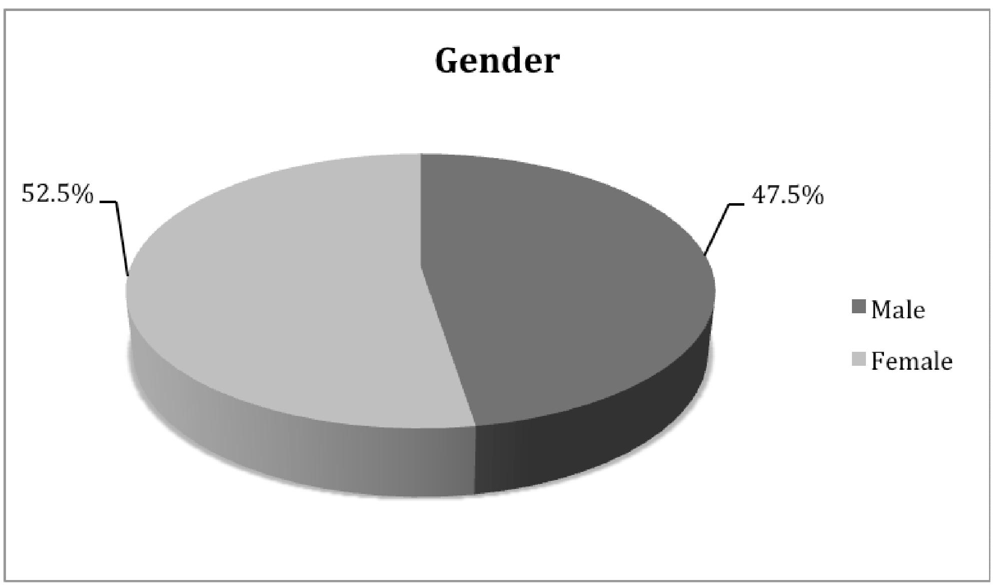

Figure 5. Gender distribution at Gifft Hill School *(N= 40).*

Student Science Grades

Scores from the 2010-2011 school year were collected for each grade's respective science class for students returning to Gifft Hill School. Iowa Test of Basic Skills science scores were also collected for students who attended Gifft Hill School during the 2010- 2011 school year. Science grades from Spring 2011 grade reports for grades 5, 6, 7, and 8 and were scored on a 4.0 scale (Table 4). The ITBS scores are reported by science percentile rank from 1 to 99 from the test date October 20, 2010 at Gifft Hill School (Table 5).

Table 4. Science course mean grade point average by grade level from 2010-2011 school year spring grade reports (*n= 29*)

Grade Level	*n*	Mean GPA	SD	Min	Max
6	9	3.74	0.66	2.00	4.00
7	5	3.13	0.87	2.00	4.00
8	9	2.96	0.77	2.00	4.00
9	6	2.67	0.37	2.33	3.00

Note. GPA measured on a 4-point scale.

Table 5. Iowa Test of Basic Skills science percentile ranks by grade level for 2010-2011 school year (*n= 29*)

Grade Level	*n*	Mean	SD	Min	Max
6	9	74.2	18.4	43	96
7	5	62.8	26.3	29	84
8	9	49.6	30.3	16	99
9	6	54.8	25.0	10	85

Note. Iowa Test of Basic Skills percentile ranks range from 1 to 99.

The reported science grades ranged from letter grades A to C+. Overall, the sixth and seventh grade students received higher science grades than the eighth and ninth grade students. A similar pattern was reflected in the Iowa Test of Basic Skills science percentile ranks. Sixth grade science scores were the highest reported scores of the four grades. Science scores, reported from fifth grade spring semester final reports, averaged a 3.74 on a 4.00 grading scale (*n*= 9; *SD*= 0.66). Corresponding Iowa Test of Basic Skills percentile ranks for the sixth grade students averaged 74.2 (*SD*= 18.4) and were the highest percentile ranks of the four grades surveyed. The seventh grade science scores for 5 students averaged 3.13 on a 4.00 grading scale (*SD*= 0.87). The seventh grade Iowa Tests percentile rank was 62.8 (*SD*= 26.3). Nine students in the eighth grade had an ending semester science grade point average of 2.96 (*SD*= 0.77) and the lowest percentile rank for the Iowa Test of Basic Skills at 49.6 (*SD*= 30.3). Finally, the ninth grade students' science grade reports were the lowest average at 2.67 (*n*= 6; *SD*= 0.37) with a percentile rank of 54.8 for the Iowa Test of Basic Skills science section (*SD*= 25.0), just above those of the eighth grade students.

Self-Efficacy in Science

The second objective was to describe the reported level of students' perceived science self-efficacy. Students were asked to rate the level to which they agreed to statements about their ability to complete and understand science-related tasks (Table 6). The students rated each question on a scale of Strongly Agree (4), Agree (3), Disagree (2), and Strongly Disagree (1).

All students thought they would do well in science class and agreed or strongly agreed that they could receive a good grade in science this year. Most students were certain they could complete the assignments for class and that they would be able to understand the topics covered in science class. The statement *I know I can earn a good grade in science this year* (*M*= 3.58; *SD*= 0.50) had the most positive student response. *I know I can do well in science this year* had nearly as high of a response with a mean of 3.53 and a standard deviation of 0.51. *I am confident that I will earn a good grade in science this year* (*M*= 3.49; *SD*= 0.51), *I am certain I can complete the assignments for science class this year* (*M*= 3.49; *SD*= 0.56), and *I am certain that I can do an excellent job in science class this year* (*M*=3.47; *SD*= 0.51) were all agreed with or strongly agreed with as well.

Table 6. Mean, standard deviation, and range of reported science self-efficacy *(N= 40)*

Statement	*n*	Mean	SD	Min	Max
I know I can earn a good grade in science this year	38	3.58	0.50	3.00	4.00
I know I can do well in science this year	38	3.53	0.51	3.00	4.00
I am confident that I will earn a good grade in science this year	37	3.49	0.51	3.00	4.00
I am certain I can complete the assignments for science class this year	37	3.49	0.56	2.00	4.00
I am certain that I can do an excellent job in science class this year	38	3.47	0.51	3.00	4.00
I am certain that I can learn the topics in my science class thoroughly	37	3.43	0.55	2.00	4.00
I can complete the tasks that the teacher assigns me in science	37	3.35	0.54	2.00	4.00
I am certain I can complete the science tasks this year that I wasn't able to complete last year	38	3.29	0.73	1.00	4.00
I can understand the material covered in science class this year	38	3.21	0.58	2.00	4.00
It is hard for me to learn about the topics in my science class because I will never use science	38	1.74	0.64	1.00	3.00
It is hard to concentrate in my science class because I do not like science	38	1.71	0.69	1.00	4.00

Note. Scale: 1= Strongly Disagree, 2= Disagree, 3= Agree, 4= Strongly Agree.

I am certain that I can learn the topics in my science class thoroughly (*M*= 3.43; *SD*= 0.55), *I can complete the tasks that the teacher assigns me in science* (*M*= 3.35; *SD*= 0.54), *I am certain I can complete the science tasks this year that I wasn't able to complete last year* (*M*=3.29; *SD*= 0.73), and *I can understand the material covered in science class this year* (*M*= 3.21; *SD*= 0.58) had an average agree response. Students did not strongly disagree with any of these statements about their ability to complete science tasks, do well in science, or understand science-related material.

The only statements that students disagreed with were *It is hard to concentrate in my science class because I do not like science* (*M*= 1.74; *SD*= 0.64) and *It is hard to concentrate in my science class because I do not like science* (*M*= 1.71; *SD*= 0.69). None of the students surveyed strongly agreed that they would never use science, but some did strongly agree that they cannot concentrate because they do not like science.

The science self-efficacy questions were additionally compared by gender. The results are displayed in Table 7 by number of male responses and means, number of female responses and means, probability ($p< 0.05$), and effect size (Cohen's *d*). There were no significant gender differences for science self-efficacy for *p*-value or effect size. Male and female students equally responded to their perceived ability to do well in science and understand science material for this school year.

Science self-efficacy questions also compared new EARTH students to returning EARTH students. The science efficacy statements are displayed in Table 8 by number of new students and means, number of returning students and means, the *p*-value ($p< 0.05$), and effect size. *I am certain I can complete the assignments for science class this year* was the only statement that was statistically significant at 0.022 with the largest effect size of all science efficacy statements. Fifteen new students (*M*= 3.73) were certain they could complete science assignments more frequently than 20 returning students (*M= 3*.30). The remaining self-efficacy questions were not statistically different. The effect size for most science efficacy statements comparing new and returning student responses were small. There were three statements that showed a moderate effect size; new students were certain they could learn science topics this year. New students were also confident they could earn a good grade in science. Returning students were confident they could learn topics in science this year that they had not learned last year.

Table 7. Mean and probability of reported science self-efficacy statements by gender *(N= 40)*

	Male		Female			Effect size
Statement	*n*	Mean	*n*	Mean	*p*	Cohen's *d*
I know I can earn a good grade in science this year	17	3.65	21	3.52	0.458	0.25
I know I can do well in science this year	17	3.53	21	3.52	0.974	0.01
I am confident that I will earn a good grade in science this year	17	3.41	20	3.55	0.416	0.27
I am certain I can complete the assignments for science class this year	17	3.41	20	3.55	0.461	0.25
I am certain that I can do an excellent job in science class this year	17	3.47	21	3.48	0.974	0.002
I am certain that I can learn the topics in my science class thoroughly	17	3.41	20	3.45	0.838	0.07
I can complete the tasks that the teacher assigns me in science	17	3.35	20	3.35	0.987	0.01
I am certain I can complete the science tasks this year that I wasn't able to complete last year	17	3.29	21	3.29	0.973	0.01
I can understand the material covered in science class this year	17	3.24	21	3.19	0.816	0.08
It is hard for me to learn about the topics in my science class because I will never use science	17	1.82	21	1.67	0.463	0.24
It is hard to concentrate in my science class because I do not like science	17	1.65	21	1.76	0.619	0.16

Note. Scale: 1= Strongly Disagree, 2= Disagree, 3= Agree, 4= Strongly Agree. Effect size small (0.20), medium (0.50 to 0.80), and large (0.80 and above).
$*p<0.05$.

Table 8. Mean and probability of reported science self-efficacy statements by new and returning students *(N= 40)*

	New Students		Returning Students			Effect Size
Statement	*n*	Mean	*n*	Mean	*p*	Cohen's *d*
I know I can earn a good grade in science this year	16	3.56	20	3.55	0.942	0.02
I know I can do well in science this year	16	3.56	20	3.50	0.719	0.12
I am confident that I will earn a good grade in science this year	15	3.60	20	3.40	0.254	0.40
I am certain I can complete the assignments for science class this year	15	3.73	20	3.30	0.022*	0.84
I am certain that I can do an excellent job in science class this year	16	3.50	20	3.40	0.562	0.20
I am certain that I can learn the topics in my science class thoroughly	15	3.60	20	3.30	0.117	0.56
I can complete the tasks that the teacher assigns me in science	15	3.40	20	3.30	0.595	0.19
I am certain I can complete the science tasks this year that I wasn't able to complete last year	16	3.06	20	3.40	0.173	0.45
I can understand the material covered in science class this year	16	3.25	20	3.15	0.612	0.17
It is hard for me to learn about the topics in my science class because I will never use science	16	1.69	20	1.80	0.613	0.17
It is hard to concentrate in my science class because I do not like science	16	1.81	20	1.70	0.635	0.16

Note. Scale: 1= Strongly Disagree, 2= Disagree, 3= Agree, 4= Strongly Agree. Effect size small (0.20), medium (0.50 to 0.80), and large (0.80 and above).
$*p<0.05$.

Attitudes Toward Gardening

Twenty-four questions addressed student attitudes toward gardening as well as garden activity questions to address the next objective, to describe student attitudes toward plants and gardening. Table 9 displays the garden attitude statements for all students surveyed. The students rated each question on a scale of Strongly Agree (4), Agree (3), Disagree (2), and Strongly Disagree (1).

Table 9. Mean, standard deviation, and range of student attitudes toward gardening and garden activities *(N= 40)*

Statement	*n*	Mean	SD	Min	Max
Watering is important to keep a garden healthy	40	3.78	0.42	3.00	4.00
I like spending time outdoors	40	3.56	0.55	2.00	4.00
Weeding is important to keep a garden healthy	38	3.53	0.65	2.00	4.00
I like when we work in the garden for class	38	3.29	0.73	1.00	4.00
I like when we use the garden at school	35	3.23	0.60	2.00	4.00
Learning how to garden is important	39	3.13	0.61	2.00	4.00
The garden at my school is important to me	39	3.10	0.55	2.00	4.00
It is important for me to care for plants	40	3.10	0.67	2.00	4.00
I plan to learn more about planting a garden	39	3.05	0.69	2.00	4.00
I feel happy when I can work with plants	39	3.03	0.67	2.00	4.00
Working in the school garden is important to me	40	3.00	0.68	2.00	4.00
I enjoy taking care of plants	40	2.98	0.58	2.00	4.00
I like to garden because I like seeing plants grow	40	2.98	0.77	1.00	4.00
I like caring for plants	38	2.97	0.64	2.00	4.00
Eating foods from the garden is important	39	2.97	0.96	1.00	4.00
I eat fruit from the school garden	38	2.89	1.03	1.00	4.00
When I am an adult, I plan to plant a garden	38	2.87	0.91	1.00	4.00
I eat vegetables from the school garden	37	2.78	0.95	1.00	4.00
I eat vegetables from my family garden	38	2.71	1.14	1.00	4.00
I eat fruit from my family garden	38	2.66	1.12	1.00	4.00
Working in the garden helps me feel better about myself	39	2.46	0.85	1.00	4.00
I think planting fruits and vegetables takes too much time	38	2.18	0.69	1.00	4.00
I don’t like to garden because I get dirty	40	1.90	0.74	1.00	4.00
I don’t like to garden because it is hard work	39	1.77	0.71	1.00	3.00

Note. Scale: 1= Strongly Disagree, 2= Disagree, 3= Agree, 4= Strongly Agree.

Students responded most positively to garden knowledge statements. Spending time outdoors, working in the school garden, and learning how to garden were all well accepted garden statements. Students were positive in response to the importance of the school garden (*M*= 3.10; *SD*= 0.55), however no students strongly disagreed with the statement. There was a similar response to the importance of plants and gardening. *It is important for me to care for plants* (*M*= 3.10; *SD*= 0.67), *I plan to learn more about planting a garden* (*M*=3.05; *SD*= 0.69), *I feel happy when I* *can work with plants* (*M*= 3.03; *SD*= 0.67), and *Working in the school garden is important to me* (*M*= 3.00; *SD*= 0.68) were similarly positively responded to.

Working in the school garden was more important to students than eating fruits and vegetables. Overall, students had positive attitudes about eating fruits and vegetables from the school garden and from home gardens. The responses to caring for plants were also positive. Students did not think planting fruits and vegetables takes too much time (*M*= 2.18; *SD*= 0.69). They also disagreed with *I don't like to garden because I get dirty* (*M*= 1.90; *SD*= 0.74) and *I don't like to garden because it is hard work* (*M*= 1.77; *SD*= 0.71).

The garden attitudes questions were compared by gender to describe any differences that could be explained by gender. Table 10 displays the number of male responses and means, number of female responses and means, *p*-values ($p < 0.05$), and effect size of garden attitude questions. From the list of garden attitude questions, two questions were statistically significant at alpha level 0.05. *Weeding is important to keep a garden healthy* had 19 male and female responses; the mean for male responses was 3.32 and the mean for female responses was 3.74. This question had a *p*-vale of 0.043. *When I am an adult, I plan to plant a garden* also had a significant *p*-vale at 0.042. There were 18 male responses with a mean of 2.56 and 20 female responses with a mean of 3.15. The 22 remaining garden questions were not significantly different. *When I am an adult, I plan to plant a garden* and *Weeding is important to keep a garden healthy* had moderate effect sizes (0.69 and 0.68, respectively). The remaining garden attitude statements had small effect sizes.

Table 10. Mean and probability of garden attitude statements by gender *(N= 40)*

	Male		Female			Effect Size
Statement	*n*	Mean	*n*	Mean	*p*	Cohen's *d*
Watering is important to keep a garden healthy	19	3.74	21	3.81	0.594	0.17
I like spending time outdoors	19	3.68	21	3.43	0.146	0.47
Weeding is important to keep a garden healthy	19	3.32	19	3.74	0.043*	0.68
I like when we work in the garden for class	19	3.32	19	3.26	0.828	0.07
I like when we use the garden at school	17	3.24	18	3.22	0.949	0.02
Learning how to garden is important	18	3.28	21	3.00	0.162	0.46
The garden at my school is important to me	18	3.17	21	3.05	0.509	0.22
It is important for me to care for plants	19	3.16	21	3.05	0.611	0.16
I plan to learn more about planting a garden	18	3.17	21	2.95	0.338	0.31
I feel happy when I can work with plants	18	3.00	21	3.05	0.827	0.07
Working in the school garden is important to me	19	3.05	21	2.95	0.647	0.15
I enjoy taking care of plants	19	3.00	21	2.95	0.798	0.08
I like to garden because I like seeing plants grow	19	2.95	21	3.00	0.832	0.07
I like caring for plants	17	2.94	21	3.00	0.781	0.09
Eating foods from the garden is important	18	3.17	21	2.81	0.252	0.38
I eat fruit from the school garden	19	2.89	19	2.89	1.000	0.00
When I am an adult, I plan to plant a garden	18	2.56	20	3.15	0.042*	0.69
I eat vegetables from the school garden	19	3.00	18	2.56	0.156	0.48
I eat vegetables from my family garden	18	2.67	20	2.75	0.825	0.07
I eat fruit from my family garden	19	2.79	19	2.53	0.477	0.23
Working in the garden helps me feel better about myself	18	2.56	21	2.38	0.532	0.20
I think planting fruits and vegetables takes too much time	17	2.35	21	2.05	0.179	0.45
I don't like to garden because I get dirty	19	1.84	21	1.95	0.646	0.15
I don't like to garden because it is hard work	18	1.78	21	1.76	0.945	0.02

Note. Scale: 1= Strongly Disagree, 2= Disagree, 3= Agree, 4= Strongly Agree. Effect size small (0.20), medium (0.50 to 0.80), and large (0.80 and above).
$p<0.05$.

New and returning EARTH students had more significant differences between them than the gender differences for garden attitudes (Table 11). New students responded more positively to *Watering is important to keep a garden healthy* (*n*= 17; *M*= 3.94) and *When I am an adult, I plan to plant a garden* (*n*= 15; *M*= 3.27). Returning students responded more positively to *I eat vegetables from the school garden* (*n*= 21; *M*= 3.10) and *Eating foods from the garden is important* (*n*= 20; *M*= 3.30). These statements also had moderate to large effect sizes ranging from 0.69 to 0.91. The remaining garden attitude questions were not significantly different for new and returning students to the EARTH program and additionally had small effect sizes.

Six additional questions from this section addressed garden efficacy and students' ability to garden at home (Table 12). This section was not as positively responded to as garden attitudes and all responses ranged from Strongly Agree (4) to Strongly Disagree (1). The highest rated statements were *I can take care of a garden* (*M*=3.08; *SD*= 0.89) and *I can help my family garden* (*M*= 3.00; *SD*= 0.77). Students were strongly divided about the ability to have a garden at home (*M*= 2.71; *SD*= 1.02). Students acknowledged the challenges of having a home garden (i.e. steep land, poor soil, living in an apartment) but were negative toward the impacts of geography on having a home garden.

Table 11. Mean and probability of garden attitude statements by new and returning students *(N= 40)*

	New Students		Returning Students			Effect Size
Statement	*n*	Mean	*n*	Mean	*p*	Cohen's *d*
Watering is important to keep a garden healthy	17	3.94	21	3.67	0.039*	0.72
I like spending time outdoors	17	3.53	21	3.57	0.820	0.07
Weeding is important to keep a garden healthy	16	3.69	20	3.40	0.194	0.45
I like when we work in the garden for class	15	3.33	21	3.24	0.709	0.13
I like when we use the garden at school	16	3.27	18	3.22	0.839	0.07
Learning how to garden is important	17	3.06	20	3.15	0.659	0.15
The garden at my school is important to me	17	3.06	20	3.15	0.633	0.16
It is important for me to care for plants	17	3.06	21	3.10	0.891	0.05
I plan to learn more about planting a garden	17	3.18	20	2.90	0.227	0.40
I feel happy when I can work with plants	16	3.06	21	3.00	0.788	0.09
Working in the school garden is important to me	17	3.06	21	2.95	0.646	0.15
I enjoy taking care of plants	17	3.06	21	2.91	0.433	0.27
I like to garden because I like seeing plants grow	17	3.00	21	2.90	0.709	0.12
I like caring for plants	17	3.00	19	2.89	0.624	0.17
Eating foods from the garden is important	17	2.65	20	3.30	0.039*	0.69
I eat fruit from the school garden	15	2.53	21	3.14	0.090	0.58
When I am an adult, I plan to plant a garden	15	3.27	21	2.62	0.035*	0.74
I eat vegetables from the school garden	14	2.29	21	3.10	0.014*	0.91
I eat vegetables from my family garden	16	2.63	20	2.75	0.755	0.11
I eat fruit from my family garden	15	2.53	21	2.71	0.648	0.16
Working in the garden helps me feel better about myself	16	2.50	21	2.48	0.936	0.03
I think planting fruits and vegetables takes too much time	17	2.06	19	2.26	0.388	0.29
I don't like to garden because I get dirty	17	1.88	21	1.95	0.779	0.09
I don't like to garden because it is hard work	16	1.63	21	1.90	0.242	0.39

Note. Scale: 1= Strongly Disagree, 2= Disagree, 3= Agree, 4= Strongly Agree. Effect size small (0.20), medium (0.50 to .80), and large (0.80 and above).
$^*p<0.05$.

Table 12. Mean, standard deviation, and range of student garden efficacy *(N= 40)*

Statement	*n*	Mean	SD	Min	Max
I can take care of a garden	37	3.08	0.89	1.00	4.00
I can help my family garden	35	3.00	0.77	1.00	4.00
I can make new friends working in the garden	37	2.89	0.84	1.00	4.00
It would be easy to garden at home	35	2.71	1.02	1.00	4.00
It is hard to have a garden at home because we have poor soil or the land is too steep	37	2.14	1.03	1.00	4.00
It is hard to have a garden at home because I live in an apartment	37	1.95	1.13	1.00	4.00

Note. Scale: 1= Strongly Disagree, 2= Disagree, 3= Agree, 4= Strongly Agree.

The garden efficacy questions were also compared by gender (Table 13). There were no significant differences between how males and females responded to the ability to garden at home. The effect sizes were small for this set of data.

Table 13. Mean and probability of garden efficacy statements by gender *(N= 40)*

	Male		Female			Effect Size
Statement	*n*	Mean	*n*	Mean	*p*	Cohen's *d*
I can take care of a garden	17	2.88	20	3.25	0.217	0.41
I can help my family garden	16	3.06	19	2.95	0.665	0.15
I can make new friends working in the garden	16	3.00	21	2.81	0.504	0.22
It would be easy to garden at home	16	2.81	19	2.63	0.607	0.18
It is hard to have a garden at home because we have poor soil or the land is too steep	17	2.18	20	2.10	0.826	0.07
It is hard to have a garden at home because I live in an apartment	16	1.69	21	2.14	0.229	0.42

Note. Scale: 1= Strongly Disagree, 2= Disagree, 3= Agree, 4= Strongly Agree. Effect size small (0.20), medium (0.50 to 0.80), and large (0.80 and above).
$^*p<0.05$.

Additionally, garden efficacy statements and statements of ability to garden at home were compared between new EARTH students and returning EARTH students (Table 14). There was no statistical difference between the mean responses for new students and the mean responses for returning students at the

0.05 level. *It is hard to have a garden at home because we have poor soil or the land is too steep* is the only statement that had a moderate effect size; the remaining statements had small effect sizes.

Table 14. Mean and probability of garden efficacy statements by new and returning students *(N= 40)*

	New Students		Returning Students			Effect Size
Statement	*n*	Mean	*n*	Mean	*p*	Cohen's *d*
I can take care of a garden	15	3.00	20	3.05	0.872	0.05
I can help my family garden	14	2.86	19	3.05	0.479	0.05
I can make new friends working in the garden	16	2.81	19	2.89	0.779	0.10
It would be easy to garden at home	14	2.71	19	2.63	0.822	0.08
It is hard to have a garden at home because we have poor soil or the land is too steep	15	2.00	20	2.25	0.499	0.50
It is hard to have a garden at home because I live in an apartment	16	2.06	19	1.89	0.674	0.14

Note. Scale: 1= Strongly Disagree, 2= Disagree, 3= Agree, 4= Strongly Agree. Effect size small (0.20), medium (0.50 to 0.80), and large (0.80 and above).
$*p<0.05$.

Attitudes Toward Peer and Community Relationships

The final object was to describe student attitudes toward peer and community relationships. The students rated each question on a scale of Strongly Agree (4), Agree (3), Disagree (2), and Strongly Disagree (1). The means and standard deviations of student attitudes toward peer and community relationships are displayed in Table 15.

Students liked working with classmates and in groups more than working alone. Similarly, they liked working with classmates in the school garden. Students also agreed with the statements *It is important that my school grows food in the garden* (*M*= 3.19; *SD*= 0.75) and *I like showing my family around my school* (*M*= 3.17;

SD= 0.89). Students agreed that it is important to have a school garden, but did not agree as strongly with the importance of helping in the school garden. They thought it is important to help their family garden, but were not as positive about showing their families around the school or the school garden. The most disagreed with responses were *I like working by myself* (M= 2.11; SD= 0.92), *I don't like showing my family where I work in the school garden* (M= 1.74; SD= 0.78), and *I don't like showing my family where I go to school* (M= 1.54; SD= 0.69).

Table 15. Mean, standard deviation, and range of student relationship statements *(N= 40)*

Statements	*n*	Mean	SD	Min	Max
I like working with my classmates	38	3.24	0.75	1.00	4.00
I like working in a group	39	3.23	0.71	1.00	4.00
It is important that my school grows food in the garden	36	3.19	0.75	1.00	4.00
I like showing my family around my school	35	3.17	0.89	1.00	4.00
I like working with my classmates in the garden	38	3.16	0.75	1.00	4.00
It is important to help my family garden	37	2.95	0.81	1.00	4.00
It is important to help my classmates garden at school	38	2.92	0.67	1.00	4.00
It is important that my family grows food in the garden	35	2.77	0.94	1.00	4.00
I like showing my family around the school garden	37	2.46	0.99	1.00	4.00
I like working by myself	38	2.11	0.92	1.00	4.00
I don't like showing my family where I work in the school garden	35	1.74	0.78	1.00	4.00
I don't like showing my family where I go to school	37	1.54	0.69	1.00	3.00

Note. Scale: 1= Strongly Disagree, 2= Disagree, 3= Agree, 4= Strongly Agree.

The peer and community relationship attitudes questions were also compared by gender. The responses in Table 16 report the number of male responses and means, number of female responses and means, the *p*-values ($p < 0.05$), and effect size. Males (*n*= 15; *M*= 3.13) agreed more frequently than females (*n*= 20; *M*= 2.50) to the importance of having a family garden at home. This was the only statement that was significantly different between genders. There were multiple statements that had moderate effect sizes for this comparison. These statements were all related to the importance of students' family growing food in the garden and showing their families where they go to school and where they work in the school garden.

Table 16. Mean and probability of relationship attitudes statements by gender *(N= 40)*

	Male		Female			Effect Size
Statement	*n*	Mean	*n*	Mean	*p*	Cohen's *d*
I like working with my classmates	17	3.35	21	3.14	0.399	0.27
I like working in a group	19	3.37	20	3.10	0.240	0.38
It is important that my school grows food in the garden	16	3.31	20	3.10	0.406	0.28
I like showing my family around my school	17	2.88	18	3.44	0.061	0.65
I like working with my classmates in the garden	19	3.32	19	3.00	0.201	0.42
It is important to help my family garden	18	3.11	19	2.79	0.235	0.40
It is important to help my classmates garden at school	17	3.12	21	2.76	0.106	0.55
It is important that my family grows food in the garden	15	3.13	20	2.50	0.047*	0.72
I like showing my family around the school garden	19	2.47	18	2.44	0.929	0.03
I like working by myself	17	1.82	21	2.33	0.091	0.56
I don't like showing my family where I work in the school garden	17	2.00	18	1.50	0.057	0.66
I don't like showing my family where I go to school	17	1.76	20	1.35	0.068	0.61

Note. Scale: 1= Strongly Disagree, 2= Disagree, 3= Agree, 4= Strongly Agree. Effect size small (0.20), medium (0.50 to 0.80), and large (0.80 and above).
$^*p<0.05$.

New and returning EARTH students were similar in attitude toward peer and community relationships. Table 17 displays the comparison between new student means and returning student means, along with the *p*-value ($p< 0.05$) and effect sizes. *It is important that my family grows food in the garden* was the only statistically different relationship statement between returning students (*n*= 19; *M*= 3.00) and new students (*n*= 14; *M*= 2.29). Returning students were more likely to agree that it is important for their family to grow food in the garden than new students. The remaining relationship attitudes statements were not statistically different for new students and returning students. Statements related to family gardens and showing families around school and the school gardens were the only statements with moderate to large effect sizes.

Table 17. Mean and probability of relationship attitudes statements by new and returning students *(N= 40)*

	New Students		Returning Students			Effect Size
Statement	*n*	Mean	*n*	Mean	*p*	Cohen's *d*
I like working with my classmates	16	3.13	20	3.25	0.626	0.17
I like working in a group	16	3.19	21	3.24	0.834	0.07
It is important that my school grows food in the garden	14	3.00	20	3.30	0.262	0.40
I like showing my family around my school	13	3.38	20	3.00	0.239	0.44
I like working with my classmates in the garden	15	3.07	21	3.19	0.638	0.16
It is important to help my family garden	15	2.67	20	3.15	0.092	0.58
It is important to help my classmates garden at school	17	2.89	19	2.88	0.957	0.02
It is important that my family grows food in the garden	14	2.29	19	3.00	0.025*	0.81
I like showing my family around the school garden	14	2.21	21	2.62	0.253	0.88
I like working by myself	15	2.20	21	2.10	0.744	0.11
I don't like showing my family where I work in the school garden	13	1.46	20	1.90	0.126	0.58
I don't like showing my family where I go to school	15	1.27	20	1.70	0.053	0.71

Note. Scale: 1= Strongly Disagree, 2= Disagree, 3= Agree, 4= Strongly Agree. Effect size small (0.20), medium (0.50 to 0.80), and large (0.80 and above).
$*p<0.05$.

Forty middle school students at Gifft Hill School participated in the EARTH program survey. This data represents a baseline for a long-term school garden study on the attitudes and science efficacy of middle school students. The findings presented in this chapter show some statistical differences between groups of students but caution should be taken when interpreting these results. This data is not significantly generalizable beyond the population at Gifft Hill School.

CHAPTER V. DISCUSSION AND CONCLUSIONS

The purpose of this study was to identify the initial beliefs and attitudes of middle school students and science self-efficacy. This collection of data will serve as baseline data in a long-term study of school garden integration into a school curriculum. This chapter presents a discussion of the findings and conclusions to represent the baseline data collected based on the objectives:

1. Describe the reported level of student self-efficacy related to academic ability, specifically science.
2. Describe student attitudes toward plants and gardening.
3. Describe student attitudes toward peer and community relationships.
4. Report the demographic characteristics of the middle school student body.

The discussion for each of the objectives is presented in three parts. The first part of each discussion will describe the overall findings for all participating students. Next, a description of the differences between gender responses will be presented. A comparison of gender responses is presented to determine and describe any differences that may be present in student responses that are dependent on gender.

Student attitudes and efficacy were finally compared by involvement in the EARTH program. New and returning EARTH participants were compared to describe any differences that can be explained by participation in the EARTH program. The returning students were students who had previously attended Gifft Hill School and had participated in the EARTH program during the 2010-2011 school year. New students to the EARTH program were students who had previously attended Gifft Hill School who were not involved in the EARTH program or students who were new to Gifft Hill School at the beginning of the 2011-2012 school year.

Demographic Characteristics

The most common problem associated with school garden research is an insufficient number of participants (Phibbs and Relf, 2005). This problem was reflected in this study as well. The demographic characteristics represent a small population (*N*= 41) of middle school students in a unique situation. While there are some significant differences reported in this study, extreme caution should be taken when drawing conclusions to populations beyond this research.

Phibbs and Relf (2005) reported that more than one-third of researchers who studied school gardens worked with middle school populations. The majority of the participants in this survey were middle school students, 17.5% were in high school and were included because of their participation in the program last year. However, only grades six, seven, eight, and nine were targeted for this survey due to the parameters of the existing garden program at Gifft Hill School. This grade level distribution resulted in 27.5% sixth graders, 30% seventh graders, 25% eighth graders, and 17.5% ninth graders. This distribution was expected according to number of students enrolled in each grade and the number of consent forms returned for each grade level.

Fifty-two percent of the participants were female, while the other 47% were male. Lineberger and Zajicek (2000) and Lautenschlager and Smith (2008) had a similar distribution of male and female participants. Females contributed 58.6% of the responses in Lineberger and Zajicek (2000), the remaining 41.4% male; similarly, 56.3% were female and 43.8% were male in Lautenschlager and Smith (2008).

From the total participant group, 55% are returning EARTH participants. These students were involved in the 2010-2011 EARTH program. Student involvement levels ranged from only participating in classroom activities (49%), which was a mandatory activity, to participating in outreach programs in the Virgin Islands (33%). There were a small number of students who also volunteered after-school time to maintaining the plants in the school garden (15%).

Overall, 72.5% of all students responded positively to having a garden before joining the EARTH program. New EARTH students were more likely to have had a garden at home prior to joining the EARTH program than returning students had before joining the program. This is an interesting finding and although there is no data to support this the research team, because of their involvement, has some speculations as to why this might be the case. The EARTH program has attracted families to Gifft Hill School within one year of establishment. Parents have enrolled students because of the positive reaction the community has had toward the garden program. Teachers have also obtained employment at Gifft Hill School because of the EARTH program. These teachers and students could be attracted to school garden because of the positive reaction the EARTH program has created within the St. John community or their interest in sustainability/the green movement. These students potentially have more garden knowledge than returning students had prior to joining the EARTH program. This characteristic could explain the difference between new and returning student garden attitude comparisons in the future.

Science Grades

Students who had previously attended Gifft Hill School had science grades that ranged from letter grades A to C+. These grades were collected from the most recent semester report cards (Spring 2011). Students in the sixth and seventh grades had an overall higher report of science grades than the eighth and ninth grade students. The younger middle school grades also had higher Iowa Test of Basic Skills percentile ranks. Students entering high school had lower averages for science scores. The following section presents a discussion of self-efficacy in science, which could further explain the students' distribution of science grades.

Self-Efficacy in Science

Science in the most common core subject taught in a garden curriculum (Graham & Zidenberg-Cherr, 2005). To describe changes in student efficacy as a result of the school garden, the science efficacy of middle school students at Gifft Hill School was measured. Students agreed with more science statements than they disagreed with. Middle school students have an overall positive science efficacy. The surveyed participants agreed or strongly agreed with four of the top science statements. Students agree that they can earn a good grade in science this year and are confident in earning a good science grade. They also agree that they can do well and do excellent in science. While student Iowa Test of Basic Skills science percentile ranks ranged from 49 to 74, science report cards for Gifft Hill School students ranged from A to C+.

Students with high self-efficacy set higher goals and are determined to succeed in class (Pajares et al., 2000), the students at Gifft Hill School believe they will do well in science class and they think they will use science. The students have interest in science and do not have particularly negative feelings about participating in or using science outside of class. Many of these students have been successful in previous science classes, which builds self-efficacy through mastery skills (Chen & Pajares, 2010). The students negatively responded to statements that presented negative connotations toward science, reflecting an all-around positive attitude toward science. Some students did acknowledge a dislike toward science, but none of the students strongly believe that they will never use science outside of the classroom.

Since science is the most common core subject taught in school garden curriculum (Graham & Zidenberg-Cherr, 2005), it is important that students experience science success and begin to develop mastery skills in science. Science achievement also improves with exposure to science-specific school garden curriculum (Smith & Motsenbocker, 2005; Klemmer et al., 2005). Structured science-related garden activities can improve science scores, which can increase science efficacy by providing positive science and garden experiences that lead to success.

Science efficacy statements, when comparing gender responses, did not significantly differ. It does not appear that one gender has stronger feelings toward science than the other gender at this school. When comparing new students to returning students, new students were significantly more confident in their ability to complete science assignments. Many of the new EARTH students are young middle school students; these students have most likely only taken general science courses, whereas the older EARTH students have experienced middle school and some high school science courses. Returning students hold a realistic view of middle school science courses because of previous experience and new students are idealistic about their upcoming year in middle school science. While experience is a good explanation, this difference could easily be monitored as part of a long-term research project.

Attitudes Toward Gardening

Middle school students were aware of the importance of garden maintenance for plant health. The students were able to agree or strongly agree the most with garden knowledge statements. Lautenschlager and Smith (2008) found changes in gardening knowledge after participating in a youth farm program. The students at Gifft Hill School positively responded to the garden knowledge statements about watering and weeding.

The Gifft Hill School students indicated interest and a positive attitude toward the school garden. Middle school students like using the school garden for class; they were more likely to agree and strongly agree with using the garden at school. Students at Gifft Hill School positively respond to the school garden and recognize the importance of utilizing the school garden. Lautenschlager and Smith (2008) concluded “age, attitude, self-efficacy, and subjective norm predicted nutrition and gardening knowledge in youth” (p. 19) which appears consistent in Gifft Hill School students. Skelly and Zajicek (1998) also reported increased positive attitudes toward the environment by participating in a structured garden program and Waliczek et al. (2001) found students with a garden program to have more positive attitudes than students attending a traditional school. The students recognize the importance of learning how to garden.

When garden attitude statements were compared by gender, females had significantly different responses toward maintaining garden health and wanting to plant a garden as an adult than males. This was consistent with the findings of Waliczek et al. (2001); females tended to respond more positively to garden programs than males. Waliczek et al. (2001) noted an effort to provide unbiased language when measuring student attitudes that, they say, is a common factor in attitude or academic differences between males and females. At Gifft Hill School, more females plan to have a garden as an adult and recognize the importance of maintaining a healthy garden. Although the trend for females to be more interested in school garden activities than males, it would be beneficial to track the changes between males and females over a longer period of time to determine if this interest will continue to differentiate males and females or if it will even out with time and experience in the garden.

Similarly, new students to the EARTH program were more likely to plan on having a garden as an adult than the returning students. From a beginner's perspective, gardening can be more appealing than to those who have previously put in many hours laboring over plants all year. New students also more strongly agreed with the importance of watering for plant health, although returning students should have experienced this during the previous school year.

Returning EARTH students ate more fruits and vegetables from the school garden than new students. This difference can be explained by experience with the previous year's produce that new EARTH students have not had access to, because the question was specific to produce from the school garden. Exposure to fruits and vegetables throughout the growing season will change the attitudes of students and student food choices (Lineberger & Zajicek, 2000; Koch et al., 2005). Overall, most students were neutral to the general importance of eating fruits and vegetables from a garden.

Additionally, most students remained neutral in their ability to take care of a garden at home, some attributed it to steep land or poor soil and some said it was because they lived in an apartment. This was consistent between males and females and new and returning students.

Garden attitudes and garden efficacy responses were generally consistent among all middle school students. There were very few differences between males and females at Gifft Hill School in their attitudes toward plants and gardening. New students to the EARTH program tended to idealize aspects of gardening and taking care of a garden. Students with experience in the school garden from the previous school year ate more fruits and vegetables out of the garden than new students.

Attitudes Toward Peer and Community Relationships

Student relationships with peers, family, and community are important to measure because community involvement in school gardens can harbor a more positive attitude of the school, the students, and the garden (Ozer, 2007). Waliczek et al. (2001) and Robinson and Zajicek (2005) noted changes in attitudes toward school and communication skills with peers after working in groups as part of a garden program. Gifft Hill School students like working with their classmates, working in groups, working with classmates in the garden, and showing family members around the school. Students were more interested in working with their peers in the school garden than working alone.

Students were somewhat neutral about showing their families around the school garden but negative toward not liking to show family around school and where they work in the school garden. Although students appear to disagree with the statements that have a negative connotation toward showing family members where they go to school, students are not ready to completely agree with all of the statements reflecting a readiness to show off the school garden. It does appear, however, that there is a level of school pride. The level of student responses to showing family around the school garden should be monitored through further to determine how this attitude changes with continued interaction in the school garden.

Students said it was more important for their school to grow food in the garden than it was for their family to grow food in the garden. Students were mostly neutral toward helping in the garden at school and at home. More males said it is important to grow food at home than females. Returning students also believed it is important to grow food at home more than new students. Returning EARTH students have experienced the benefits of growing food at school and were able to take home plant lessons and share the experience of trying new fruits and vegetables with friends and family members. It is easy to explain why more returning students think it is important to grow food at home, but from current data it is hard to explain why males would have a similar attitude. Males did not respond more positively than females to any other relationship or garden attitude questions.

Conclusions

Students at Gifft Hill School are recognizing the importance and the impact of growing and eating food in school and family gardens. There are a small number of differences between new student responses and returning student responses to experiences in the EARTH program. Considering the amount of time returning students have had in the school garden compared to the new students, the difference seen between new and returning students is not unexpected. Comparing new and returning students can describe how the school garden experience affects students' attitudes; however, continued research in this area would provide a more descriptive difference between the experience of new students and returning students.

The baseline data collected from the EARTH Survey 2011 generally appears consistent with the current literature on school gardens. The limitation for this study was the relatively small number of participants. Students were also predominantly middle school students, however that was because of the existing EARTH program participant structure more than any other factors.

The baseline data collected from the EARTH program survey follows the objects set for this study. The conclusions drawn from the data are as follows.

1. Based on the students' perception of science, Gifft Hill School middle school students are confident in their ability to complete science-related tasks.

2. Student responses reflect positively toward their science ability.
3. Returning middle school students have a more realistic view of science classes than new students.
4. Students recognize the importance of maintaining plants, caring for plants in the garden, and learning how to garden.
5. Females are more inclined to want to plant a garden as an adult than male students.
6. New EARTH students are more inclined to idealize gardening than returning students who appear more realistic toward their approach to gardening, which comes with experience.
7. Students are developing a positive attitude toward eating fruits and vegetables from the garden with experience as seen by the difference between new and returning students, which is consistent with school garden literature (Lineberger & Zajicek, 2000; Koch et al., 2005).
8. Students acknowledge the importance of working with their peers, particularly in the school garden, which from school garden research increases students' communication skills and ability to work well with peers (Ozer, 2007).

CHAPTER VI. SUMMARY, RECOMMENDATIONS, AND IMPLICATIONS

Summary

The purpose of this study was to identify the initial beliefs and attitudes of middle school students and their perceived science self-efficacy. As the first step in a long-term school garden study, this collection of data will serve as a baseline for future data collection. To capture student attitudes, a descriptive survey was used. The survey instrument focused on science efficacy, garden attitudes, and student relationships to fulfill the following four objectives:

1. Describe the reported level of student self-efficacy related to academic ability, specifically science.
2. Describe student attitudes toward plants and gardening.
3. Describe student attitudes toward peer and community relationships.
4. Report the demographic characteristics of the middle school student body.

These objectives were specific to middle school students at Gifft Hill School, St. John, USVI. These participants were chosen because of their involvement in a school garden program designated for middle school students. The students who participated in the study were in the sixth, seventh, eighth, and ninth grade.

Of the 54 eligible respondents, 40 students participated in the survey. Additionally, for these 40 students, the science grades from Spring 2011 report cards and Iowa Test of Basic Skills science percentile ranks were collected to help describe student ability and success in science. The findings of this study were reported in four sections: demographics, science efficacy, garden attitudes, and student relationships. Descriptive statistics were provided for all four sections, including means, standard deviations, range, frequencies, and percentages. Cronbach's alpha was also used to determine the reliability of the three main objectives, science efficacy, garden attitudes, and student relationship attitudes (.71, .82, and .54, respectively). Fischer's least significant difference test was used to compare the data and Cohen's *d* is also included as part of the data analysis to show effect size when comparing gender responses and new and returning EARTH students. While analyzing the data, some significant differences were seen when comparing gender responses and new and returning student responses. However, these results are interpreted with caution because the number of participants was small and is not generalizable to larger, differentiated populations.

Students reported positive attitudes toward science, implying high levels of self-efficacy. Middle school students think they can and are certain that they will do well in science. Students are also confident in their ability to get good grades in science class this year. These students are able to identify that they disagree with statements that negatively reflect science. There were no significant differences between genders. The only noticeable difference between new and returning EARTH students was the increased confidence new students showed in their ability to complete science assignments.

From the garden attitudes responses, all students were identified as having high garden maintenance knowledge. All middle school students can identify the importance of maintenance for plant health. Differences were noted for students who planned on planting a garden as an adult, these students included females and new students. Females were more likely to have interest in garden activities in other school garden studies (Waliczek et al., 2001).

Returning EARTH students had an advantage over new students when responding to eating fruits and vegetables from the school garden. There were some significant differences between these groups because of the level of involvement in the EARTH program, which was to be expected. These differences should be monitored as a long-term study progresses to determine their significance.

The third objective, to describe student attitudes toward their peer and community relationships in relation to the school garden, was the least reliable section. There were some significant differences between new and returning students about the importance of family gardens. Returning EARTH students valued family gardens; participating male students held a similar view of the importance of having a family garden.

Some conclusions can be drawn from the baseline data collected from this survey, but further research should be conducted to expand on the findings presented in this study and explain in more detail the effects the school garden has had on student attitudes and beliefs at Gifft Hill School. The next sections present recommendations and suggestions for further research as identified by the data collected for this study.

Recommendations

Through the process of compiling baseline data for the garden program at Gifft Hill School, there were several recommendations for faculty and administration. Currently there is not an established outline for the garden program or an integrated curriculum for including and using the school garden in middle school courses and the school garden is not accessed outside of the EARTH program class period. In order for the EARTH program to be a successful school-wide program, faculty and administration need to develop a shared vision for the integration of the school garden curriculum into current Gifft Hill School courses. The vision, along with a plan for implementation, should be aided through school workshops and all-faculty planning sessions. Faculty and administration should work together to create a thoughtful learning environment for the students of Gifft Hill School. Integration of a school garden program into the middle school curriculum can be modeled from other school garden programs, like the Edible Schoolyard in Berkley, California where program and lesson planning is available (Chez Panisse Foundation, 2008). These established garden-based learning programs can serve as models and provide resources for schools wanting to also develop an integrated garden program.

Future Research

To enhance and further explain the baseline data that was collected from this study, recommendations for future research are included. The purpose of this research was to provide a baseline for the school garden program at Gifft Hill School. This data can be utilized and better show the effects of the garden program on student attitudes and beliefs by administering the survey again at a later date. The end of the fall semester, 2011, would be an appropriate time to measure student attitudes. Ideally, the following spring semester, 2012, would fully capture student attitudes toward the garden program after one year of participation. To measure long-term changes, student attitudes should be measured at the beginning and the end of each school year. However, it is apparent that the student culture at Gifft Hill School changes frequently and to appropriately capture student attitudes, the survey may need to be administered each semester.

Future research should focus on the differences between new and returning students to the EARTH program. Returning students hold a realistic view of middle school science courses because of previous experience whereas new students are idealistic about their upcoming year in middle school science. The changes in the attitudes of new and returning students toward their ability to complete science assignments should be followed and explained further to determine if this is a belief held only at the beginning of middle school science and if it remains consistent with incoming middle school students. New and returning student attitudes differ in terms of gardening and fruit and vegetable preferences as well; these differences would be better explained by long-term data collections.

The trend for females to be more interested in school garden activities should be explored further. Will this attitude stay consistent with male and female students as the long-term study progresses? A long-term analysis of gender comparisons will better explain the differences in gender interest to garden programs.

To better explain the changes in student attitudes toward peer and community relationships, the respective portion of the survey should be expanded to reflect student interactions with these peer and community groups in relation to the school garden. Students currently do not have significantly strong feelings toward showing family members where they work in the school garden, but school garden research (Ozer, 2007) describes changes in communication and relationships as school garden participation progresses. Continuation of this long-term study on the effect of a school garden program on student attitudes will be able to better explain and show any changes in student attitudes and beliefs toward science, gardening, and relationships.

A study of faculty and administration, as well as community, involvement in the EARTH program would complement the study of the student environment. Changes in curriculum development, course structure, and administrative processes could be documented for the purpose of the school garden integration process. Phibbs and Relph (2005) surveyed former school garden researchers; these researchers suggest using a combination of quantitative and qualitative studies to best capture and explain school garden programs; this method would be an appropriate step for the garden research at Gifft Hill School to describe the changes taking place as a result of the marriage of the EARTH program and Gifft Hill School.

Implications and Educational Significance

Implications of this study can be drawn from relating the impact of school gardens to self-efficacy and student learning processes. The EARTH program coordinators at Gifft Hill School and Iowa State University have the opportunity to develop an integrated garden program that considers the impacts school gardens have on student learning and attitudes. By including how students learn and also by measuring the attitudes as a result of the garden program, program coordinators can help the EARTH program evolve into a wholly inclusive experience where students are able to use the garden but also apply course concepts to those garden activities.

Students learn by experiencing and changing their thought processes, consistent with experiential learning theory. These students are also a part of a bigger system, influenced by many surrounding factors. The social cognitive theory of personal, environmental, and behavioral factors, along with experiential learning theory provide an environment for students to gain experience and appropriately shape new ideas, in this case, about gardening. Through a structured garden program, integration into the school curriculum, and monitoring progress, students and school administration can benefit from the changes in student attitudes and academic efficacy.

When the participating students are able to use garden experience to aid their own science learning experience, they are building science efficacy. These students benefit from the transfer of academic efficacy from the garden program to the classroom. The results of this study, along with future data, provide support for and describe changes that take place in student attitudes and academic efficacy with the integration of a garden program.

ID# ____________________

EARTH Program Survey
Fall 2011

Thank you for filling out this survey. We want to know how you feel about gardening and how well you like science classes. Please answer the questions with the answer that you think is most like how you feel. There aren't any right or wrong answers and you can skip any questions you aren't comfortable answering. You may ask questions as you fill out the survey.

Definitions: Some of these questions ask about gardens that you may work in. A **garden** can be a container, raised bed, or in-ground garden that grows fruits, vegetables, and other plants. Questions that ask about the **school garden** refer to the gardens at Gifft Hill School. The questions that ask about a **family garden** are asking about gardens that your family takes care of.

Directions: Please read each statement carefully. Circle the answer that you think is most like how you feel about the statement. Please only circle one answer for each question.

	Strongly Agree	Agree	Disagree	Strongly Disagree
I like spending time outdoors.	SA	A	D	SD
I enjoy taking care of plants.	SA	A	D	SD
I like caring for plants.	SA	A	D	SD
I think planting fruits and vegetables takes too much time.	SA	A	D	SD
I like working by myself.	SA	A	D	SD
I like working in a group.	SA	A	D	SD
I don't like to garden because I get dirty.	SA	A	D	SD
I don't like to garden because it is hard work.	SA	A	D	SD
Weeding is important to keep a garden healthy.	SA	A	D	SD
Watering is important to keep a garden healthy.	SA	A	D	SD

ID# ____________________

	Strongly Agree	Agree	Disagree	Strongly Disagree
It is important for me to care for plants.	SA	A	D	SD
Working in the school garden is important to me.	SA	A	D	SD
Working in the garden helps me feel better about myself.	SA	A	D	SD
I like when we work in the garden for class.	SA	A	D	SD
I like working with my classmates in the garden.	SA	A	D	SD
I like when we use the garden at school.	SA	A	D	SD
It is important to help my classmates garden at school.	SA	A	D	SD
I feel happy when I can work with plants.	SA	A	D	SD
The garden at my school is important to me.	SA	A	D	SD
Learning how to garden is important.	SA	A	D	SD
I like to garden because I like seeing plants grow.	SA	A	D	SD
I eat fruit from my family garden.	SA	A	D	SD
I eat vegetables from my family garden.	SA	A	D	SD
It is important to help my family garden.	SA	A	D	SD
Eating foods from the garden is important.	SA	A	D	SD
I eat vegetables from the school garden.	SA	A	D	SD
I eat fruit from the school garden.	SA	A	D	SD
I like showing my family around the school garden.	SA	A	D	SD
I plan to learn more about planting a garden.	SA	A	D	SD
When I am an adult, I plan to plant a garden.	SA	A	D	SD

	Strongly Agree	Agree	Disagree	Strongly Disagree
I can understand the material covered in science class this year.	SA	A	D	SD
It is important that my family grows food in the garden.	SA	A	D	SD
It is hard to have a garden at home because I live in an apartment.	SA	A	D	SD
It is hard to have a garden at home because we have poor soil or the land is too steep.	SA	A	D	SD
I am certain I can complete the assignments for science class this year.	SA	A	D	SD
I am certain that I can do an excellent job in science class this year.	SA	A	D	SD
I am confident that I will earn a good grade in science this year.	SA	A	D	SD
I am certain I can complete the science tasks this year that I wasn't able to complete last year.	SA	A	D	SD
I don't like showing my family where I work in the school garden.	SA	A	D	SD
I can take care of a garden.	SA	A	D	SD
I don't like showing my family where I go to school.	SA	A	D	SD
I can complete the tasks that the teacher assigns me in science.	SA	A	D	SD
I like showing my family around my school.	SA	A	D	SD
It is important that my school grows food in the garden.	SA	A	D	SD
I know I can do well in science this year.	SA	A	D	SD
I know I can earn a good grade in science this year.	SA	A	D	SD
I can make new friends working in the garden.	SA	A	D	SD
I can help my family garden.	SA	A	D	SD
I am certain that I can learn the topics in my science class thoroughly.	SA	A	D	SD
It is hard for me to learn about the topics in my science class because I will never use science.	SA	A	D	SD
It is hard to concentrate in my science class because I do not like science.	SA	A	D	SD
I like working with my classmates.	SA	A	D	SD
It would be easy to garden at home.	SA	A	D	SD

Please check if you are a new or returning student to GHS. If you are a returning student, check all of the activities that you were part of for the EARTH program last year (2010-2011schoolyear).

☐ I am a new student to GHS this year and did not participate in the EARTH program last year.

☐ I was a student at GHS last year and I did participate in the EARTH program last year.

- ☐ I participated in the classroom and garden activities scheduled by the teacher.
- ☐ I participated in outreach activities like Earth Day, Ag. Market Day, VISFI, hosting the cocktail party & Dean's tours.
- ☐ I volunteered my time to maintain the garden before, during, or after school.

Did your family have a garden at home before you started working in the school garden?

- ☐ Yes
- ☐ No

Have you or your family started a garden at home since you started working in the school garden?

- ☐ Yes
- ☐ No

How long have you attended GHS? (years): ____________

Where did you attend school prior to GHS?

- ☐ Public school in territory
- ☐ Private school in territory
- ☐ State-side school
- ☐ Homeschool
- ☐ Only Gifft Hill School

Grade: 6 7 8 9

I am: ___ Male ___ Female

APPENDIX B. HUMAN SUBJECTS APPROVAL

IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY

Institutional Review Board
Office for Responsible Resear
Vice President for Research
1138 Pearson Hall
Ames, Iowa 50011-2207
515 294-4566
FAX 515 294-4267

Date: 8/22/2011

To: Elizabeth Childs
3021 Regency Ct 89
Ames, IA 50010

CC: Dr. Michael Retallick
206 Curtiss Hall

From: Office for Responsible Research

Title: Impact of School Gardens on Student Attitude and Beliefs Survey

IRB Num: 11-345

Approval Date: 8/19/2011 **Continuing Review Date:** 8/14/2011

Submission Type: New **Review Type:** Expedited

The project referenced above has received approval from the Institutional Review Board (IRB) at Iowa State University. Please refer to the IRB ID number shown above in all correspondence regarding this study.

Your study has been approved according to the dates shown above. To ensure compliance with federal regulations (45 CFR 46 & 21 CFR 56), please be sure to:

- **Use only the approved study materials** in your research, **including the recruitment materials and informed consent documents that have the IRB approval stamp.**
- **Obtain IRB approval prior to implementing** any **changes** to the study by submitting the "Continuing Review and/or Modification" form.
- **Immediately inform the IRB** of (1) **all serious and/or unexpected adverse experiences** involving risks to subjects or others; and (2) **any other unanticipated problems** involving risks to subjects or others.
- **Stop all research activity if IRB approval lapses,** unless continuation is necessary to prevent harm to research participants. Research activity can resume once IRB approval is reestablished.
- **Complete a new continuing review form** at least three to four weeks prior to the **date for continuing review** as noted above to provide sufficient time for the IRB to review and approve continuation of the study. We will send a courtesy reminder as this date approaches.

Research investigators are expected to comply with the principles of the Belmont Report, and state and federal regulations regarding the involvement of humans in research. These documents are located on the Office for Responsible Research website http://www.compliance.iastate.edu/irb/forms/ or available by calling (515) 294-4566.

Upon completion of the project, please submit a Project Closure Form to the Office for Responsible Research, 1138 Pearson Hall, to officially close the project.

APPENDIX C. PARENT CONTACT LETTER

Dear Parents,

You are receiving this letter because your son or daughter is enrolled at Gifft Hill School as a sixth, seventh, eighth, or ninth grader. Students who are entering the seventh, eighth, or ninth grade may be familiar with the EARTH program at GHS. Last year a garden was installed at the school and your child may have had the opportunity to participate in gardening and cooking activities through their classes.

While some students participated in EARTH program activities last year, it is still very new to GHS. Students and professors from Iowa State University are involved in organizing learning and research projects using the school's new garden. In order for us to know what kind of an impact the garden is having on student attitudes and academic behaviors, we have to collect information from the students participating in the EARTH program in the form of a survey.

Attached you will find two copies of the consent form that describes the survey we wish to deliver to your GHS student. The consent form contains information you and your son or daughter should read before participating. If you agree to have your son or daughter participate in the survey, sign one copy of the consent form and return the document to Gifft Hill School by September 12, 2011 and keep the other copy for your records.

Thank you for taking time to read the consent form. By participating in surveys like this one, educators are able to provide activities that are meaningful and relevant to students. If you or your student have any questions about research or the procedure for the survey, please do not hesitate to ask.

Sincerely,

Elizabeth Childs
Iowa State University
Agricultural Education & Studies
Graduate Student

Sarah Haynes
EARTH Program Coordinator
Gifft Hill School

APPENDIX D. INFORMED CONSENT

Title of Study: Student Attitude and Self-Efficacy Survey for the EARTH Program School Garden

Investigators: Elizabeth Childs, Mike Retallick, Ph.D., Jennifer Bousselot, Ph.D.

This is a research study. This form has information to help you decide whether or not you wish for your child to participate. Research studies include only people who choose to take part—your child's participation is completely voluntary. Please feel free to ask questions at any time.

Your child is being asked to take this survey because he or she is in 6th, 7th, 8th or 9th grade at Gifft Hill School. The purpose of this survey is to determine the impact of the school gardens on students' attitudes, academic beliefs, and participation at school over a period of time.

If your child agrees to participate, he or she will be asked to answer questions on a survey during the school day. The survey will ask the your child questions about working in a garden, importance of gardening, interest in science, and performance in science class this year. Your child's participation will last about 30 minutes. Your child can skip any questions that he or she does not wish to answer. We will also collect existing records from your child's school. These records include: previous academic data and records, test scores, Iowa Test of Basic Skills scores, student demographics, and student socioeconomic data. These records will **not** include student or family names or identification and only group averages will be reported.

If you decide to let your child participate in this survey there will be no direct benefit to you or your child. However, it is hoped that the information gained from this survey will help Gifft Hill School provide a quality educational garden program.

There is no cost to your child by participating in this study. Your child will not be compensated for participating in this study. Participating in this study is completely voluntary. Your child may choose not to take part in the study or to stop participating at any time, for any reason, without penalty or negative consequences.

Records identifying participants will be kept confidential to the extent allowed by applicable laws and regulations. Records will not be made publicly available. However, federal government regulatory agencies, auditing departments of Iowa State University, and the ISU Institutional Review Board (a committee that reviews and approves research studies with human subjects) may inspect and/or copy your records for quality assurance and analysis. These records may contain private information.

To ensure confidentiality to the extent allowed by law, access to study records will be available to members of the research team only, and will be contained in a locked cabinet to ensure confidentiality. If the results are published, your child's identity will remain confidential.

You are encouraged to ask questions at any time during this study. For further information about the study contact Elizabeth Childs, 251 Horticulture Hall, Ames, IA 50011, 515-294-1273; echilds@iastate.edu or Dr. Michael Retallick, 206 Curtiss, Ames, IA 50011, 515-294-4810; msr@iastate.edu. If you have any questions about the rights of research subjects or research-related injury, please contact the IRB Administrator, (515) 294-4566, IRB@iastate.edu, or Director, (515) 294-3115, Office for Responsible Research, 1138 Pearson Hall, Iowa State University, Ames, Iowa 50011.

Consent and Authorization Provisions

Your signature indicates that you voluntarily agree to let your child participate in this study, that the study has been explained to you, that you have been given the time to read the document and that your questions have been satisfactorily answered.

Parent/Guardian's Name (printed) ______________________________

______________________________ ______________________

(Signature of Parent/Guardian or Legally Authorized Representative) (Date)

Student Consent

I am willing to participate in this study about the school gardens project at Gifft Hill School. I am aware that I am volunteering to participate and answer questions on how I feel about the school gardens. I know that my answers will be collected and that they will not have my name attached.

Participant's Name (printed) ______________________________

______________________________ ______________________

(Signature of Student Participant) (Date)

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