LESSONS FROM THE GARDEN: GARDEN BASED NUTRITION EDUCATION AT TWO ELEMENTARY SCHOOLS

By

Caroline Lucille Martin

A THESIS

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

MASTER OF SCIENCE

Human Nutrition

2011

ABSTRACT

LESSONS FROM THE GARDEN: GARDEN-BASED NUTRITION EDUCATION AT TWO ELEMENTARY SCHOOLS

By

Caroline Lucille Martin

American children consume inadequate amounts of fruits and vegetables. Establishing adequate fruit and vegetable intake during childhood is an important step in establishing lifelong intake. Garden-based nutrition education (GBNE) has been shown to positively impact childrens' knowledge about, preference for and intake of fruits and vegetables. This study explored student and staff experiences with GBNE at two elementary schools. Data were obtained by conducting interviews and participant observation, and by collecting student work. Perceived outcomes, facilitators and barriers associated with GBNE emerged as themes. Outcomes, included: (1) enhanced nutrition knowledge, attitudes and behaviors, (2) improved understanding of food systems, (3) enhanced school learning experience, (4) character development, (5) enhanced life experience, (6) intergenerational relationships and community engagement, and (7) feelings of enjoyment, wonder and therapeutic effects. Facilitators included: (1) funding and community support, (2) presence of a garden champion and garden allies, (3) communication and school support, and (4) positive student feedback. Barriers included: (1) limitations in garden design, (2) seasonal limitations, (3) vandalism, (4) funding restrictions, (5) time constraints, (6) large classes, behavior problems and perceived lack of control, and (7) limited communication. Outcomes were used to develop a conceptual model describing the route through which GBNE increases students' fruit and vegetable intake. Facilitators and barriers were used to identify recommendations for the practical implementation of GBNE programs.

This work is dedicated to the children, educators and volunteers – that they may always find a place in the garden.

ACKNOWLEDGEMENTS

The children and adults of Janesville and Gilsonville Elementary Schools graciously and wholeheartedly welcomed me, and for that I am deeply thankful. The nutrition educators and volunteers at the schools were especially important to this project and I offer my most sincere gratitude for their kindness, energy and dedication.

I am also grateful to my major advisor, Dr. Katherine Alaimo, for her initial openness to taking me into her lab group and for her constant encouragement to pursue my interests – in both my current research and future career plans. My master's guidance committee, Dr. Katherine Alaimo, Dr. Marsha Carolan, Dr. Laurie Thorp and Dr. Lorraine Weatherspoon also provided valuable advice, assistance and encouragement throughout the research process. I am lucky to have had these talented and kind women as mentors and advisors. The Michigan State University Department of Food Science and Human Nutrition and Dr. Katherine Alaimo provided financial support that allowed me to conduct this research. I would also like to thank the Michigan Nutrition Network, Becky Henne, Anne Scott and Diane Golzynski for their support.

I am grateful to the Community Nutrition faculty and graduate students within the Department of Food Science and Human Nutrition. They taught me how to channel my curiosity, ask questions, conduct research, and share my findings. I must also thank current and former Alaimo lab students and staff, including Kellie Mayfield, Dr. Jennifer Lucarelli, Richard Miles, Tiffany Chritz, Caitlin Fisher, Liz Weber, Ellen Mang, Deb Bailey and Deanne Kelleher, who provided assistance and support throughout my time at Michigan State.

This acknowledgement would not be complete without expressing deepest thanks to my friends and family. Nicky, Kellie, Josh and Hilary, you never fail to bring a smile to my face. To

mom, dad, Beth and Kristin - thank you for believing in me and for your love and support every step of the way. And finally, I must acknowledge two of my favorite Michiganders, Lucille Jane and Robert Gilson, for their inspiration as I wrote this manuscript.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1: INTRODUCTION

1.1 Overview and Gap in Knowledge

Eating patterns learned and established during childhood impart lasting effects on lifelong dietary habits. (Nicklas, Baranowski, Cullen, & Berenson, 2001; Westenhoefer, 2002; Fisher & Birch, 2001; Mikkila, Rasanen, Raitakari, Pietinen, & Viikari, 2005; Singer, Moore, Garrahie & Ellison, 1995). Consuming adequate amounts of fruits and vegetables as part of a healthy diet provides important nutrients and phytochemicals that reduce the risk of disease (Duncan, Bacon, & Weinsier, 1983; Kris-Etherton, Lefevre, Beecher, Gross, Keen & Etherton, 2004; Hu & Willett, 2002; Epstein, Gordy, Raynor, Beddome, Kilanowski & Paluch, 2001; Steinmetz & Potter, 1991). Likewise, adequate fruit and vegetable intake is associated with lower incidence of overweight, obesity, cardiovascular disease, and certain cancers (Bazzano, 2006; Lin & Morrison, 2002; He, Hu, Colditz, Monson, Willet & Liu, 2004; Van Duyn & Pivonka, 2000; Bazzano et al., 2002). In 1999-2000, fewer than 20% of children 4-13 years of age, consumed five or more servings of fruits and vegetables per day (Guenther, Dodd, Reedy & Krebs-Smith, 2006). Similarly, the CDC reported that in 2009 only about 22% of high school students nationwide consumed five or more servings of fruits and vegetables per day. (United States Department of Health and Human Services, 2010c)

National health and research organizations including the United States Department of Health and Human Services (DHHS) (2010a), the National Cancer Institute (NCI) (2010d), and the United States Department of Agriculture (USDA) (2011a) recognize the importance of fruit and vegetable intake in maintaining a healthy diet and in turn promoting lifelong health (DHHS, 2010a; DHHS, 2010d; USDA, 2011a). Therefore, developing effective techniques to promote

fruit and vegetable consumption among youth is an important step in the effort to reduce childhood obesity and chronic disease, and to promote health.

In light of the widespread inadequacy of fruit and vegetable intake among youth, schools have been identified as important and effective sites for health and nutrition interventions. Most American children attend school (United States Census Bureau, 2003). Schools serve as platforms through which health and nutrition interventions reach large and diverse groups of youth (French & Stables, 2003; Briggs & Safai, 2003; Story, Kaphingst & French, 2006; DHHS, 2001; MDE, 2001; Ritchie, Crawford, Hoelscher & Sothern, 2006). School nutrition programs aim to protect children from the effects of food insecurity and hunger, and to provide nutrition education as part of a national effort to improve nutrition status and prevent overweight, obesity and chronic disease among the population (Stang, Taft Bayerl & Flatt, 2006).

Garden-based nutrition interventions, especially within schools, have gained popularity in recent years (Robinson-Obrien, Story & Heim, 2009). A growing body of literature suggests that school gardens are useful teaching tools for nutrition educators and that school gardens may positively impact students' knowledge, skills, attitudes and behaviors with regard to fruits and especially vegetables (Hermann, Parker, Brown, Siewe, Denney & Walker, 2006; McAleese & Rankin, 2007; Morris, Briggs & Zidenberg-Cherr, 2000; Morris & Zidenberg-Cherr 2002). In addition to nutrition education, school gardens offer an opportunity for enhancement of academic instruction. Integration of garden-based activities into classroom lessons allows educators to promote hands-on nutrition education while also meeting mandated teaching requirements (Graham, Beall, Lussier, McLaughlin & Zidenberg-Cherr, 2005; Graham & Zidenberg-Cherr, 2005). Nutrition education intervention programs that provide hands-on, multidisciplinary

activities are recommended over traditional didactic programs and are thought to be more effective at promoting behavior change (Lytle & Achterberg, 1995).

Although numerous quantitative studies have assessed nutrition outcomes associated with school garden-based nutrition education (GBNE), few qualitative studies have explored the school gardening experience with a focus on nutrition. This study provides a unique perspective, presenting nutrition-related and non nutrition-related outcomes and characteristics associated with GBNE. Findings from this study suggest that further investigation of nutrition-related outcomes associated with GBNE may benefit from examination of factors beyond the traditional realm of nutrition.

1.2 Rationale and Study Aims

The purpose of this study was to understand how school GBNE programs were experienced by staff and students at two elementary schools in the Midwest. The two school garden programs included in the study, both partially funded through the USDA Supplemental Nutrition Assistance Program Education (SNAP-Ed), shared a common goal: to increase fruit and vegetable consumption among children. Additional key goals of SNAP-Ed funded nutrition education programs include promoting consumption of whole grains and low fat or fat free dairy products every day, balancing energy intake with energy expenditure, and engaging in daily physical activity as part of a healthy lifestyle (USDA, 2010).

The focus of this research grew from key points presented by SNAP-Ed funded school garden-based nutrition educators at a regional round-table discussion of the facilitators and barriers to GBNE (Scott, 2011). This discussion led to the researcher's interest in exploring student and staff experiences with and perceptions of school GBNE. The focus of this study was

not to evaluate the behavioral outcomes of GBNE, rather it was to understand participant experiences with school GBNE programs in the Midwest. This study utilized a grounded-theory approach and therefore data were collected with a goal of theory development (Corbin & Strauss, 1990).

1.2.1 Study Aims

The following study aims provided a guide for the exploration of student and school staff experiences with school GBNE.

Study Aim 1: To understand administrator, staff, and student experiences of school-based gardens in two elementary schools in the Midwest.

Study Aim 2: To understand the roles that these school gardens serve in two elementary schools in the Midwest.

Study Aim 3: To understand the dynamic relationships between school personnel and how the garden fits into these relationships.

Study Aim 4: To understand how the student experience of the school gardens compare to why and how teachers and other staff use the garden.

Study Aim 5: To provide useful information regarding challenges and potential resources that should be considered when developing a school garden program.

As the process of data collection and analysis progressed, a broad-reaching understanding of the gardens evolved. The information provided in this thesis, relating to nutrition and beyond,

may inform the planning and implementation process, as well as research efforts, for future school GBNE programs.

1.3 Organization of Thesis

The following chapters include a review of the literature, two manuscripts presenting findings from the study and a final summary chapter. In the literature review (Chapter Two) information regarding fruit and vegetable intake as it relates to chronic disease and health outcomes among children, determinants of fruit and vegetable intake among children, and fruit and vegetable recommendations and trends will be presented. A brief review of school-based nutrition intervention programs, especially those that focus on improving fruit and vegetable intake among children, and a review of garden-based learning will follow. A description of pertinent quantitative and qualitative studies exploring school gardens will also be provided in Chapter Two. The first manuscript (Chapter Three) examines perceived outcomes associated with school GBNE. The second manuscript (Chapter Four) explores facilitators and barriers to school GBNE. A brief introduction, description of methods and data analysis, presentation of results, discussion and conclusions will be provided in Chapters Three and Four. In Chapter Five, findings presented in the previous two chapters will be summarized. Chapter Five will also include a summary, strengths and limitations and overall conclusions.

CHAPTER 2: LITERATURE REVIEW

2.1 Fruit and Vegetable Intake

2.1.1 Chronic Disease

Poor diet and physical inactivity contribute to almost 20% of annual deaths in the United States, second only to tobacco use (Mokdad, Marks, Stroup & Gerberding, 2004). The top three leading causes of death - heart disease, cancer, and stroke - and the sixth leading cause of death, diabetes mellitus, have been linked to physical inactivity and poor diet, including inadequate fruit and vegetable intake (Heron, 2010; Bazzano et al., 2002; Joshipura et al., 2001; He, Nowson & MacGregor, 2006; Joshipura et al., 1999; Steinmetz & Potter, 1996; Van Duyn & Pivonka, 2000). Incorporating adequate amounts of fruits and vegetables into the diet not only displaces energy dense food choices with nutrient dense options; it also provides important nutrients and phytochemicals that reduce the risk of certain diseases (Duncan, Bacon & Weinsier, 1983; Kris-Etherton et al., 2004; Hu & Willett, 2002; Epstein et al., 2001; Steinmetz & Potter, 1991).

Fruit and vegetable intake is protective against cardiovascular disease morbidity and mortality (Bazzano et al., 2002). In addition, fruits and vegetables provide important nutrients, including antioxidant vitamins, minerals such as magnesium and potassium, and fiber - which are believed to play important roles in the dietary prevention of certain cancers and diabetes mellitus (Joshipura et al., 2001; USDA, 2011a). Bazanno et al. (2002) analyzed data from NHEFS, a prospective cohort follow-up study to NHANES-I, and found fruit and vegetable consumption inversely associated with cardiovascular disease and overall mortality (Bazzano et al., 2002). Similarly, Joshipura et al. (2001) showed an inverse association between fruit and

vegetable consumption and heart disease among men and women enrolled in the Nurses' Health Study and the Health Professionals' Follow Up Study. The most significant dietary contributors to the protective effect of fruits and vegetables against the development of heart disease were green leafy vegetables and vitamin-C rich fruits and vegetables (Joshipura et al., 2001). Boeing et al. (2006) found an inverse relationship between both fruit and vegetable consumption and the incidence of cancer in the upper aero-digestive tract, and Voorips et al. (2000) showed an inverse relationship between fruit and vegetable intake and the incidence of lung cancer (Boeing et al., 2006; Voorips et al., 2000). In a study by Sargeant et al. (2001), fruit and green leafy vegetable intake was inversely associated with glycosylated hemoglobin levels among adults. This association was found after adjustment for dietary fiber and saturated fat and plasma vitamin-C levels (Sargeant et al., 2001).

2.1.2 Related Health Outcomes in Children

Poor diet, and in particular, inadequate fruit and vegetable intake has been associated with impaired health, growth, and development during childhood (Nicklas & Johnson, 2004; DHHS, 1996). Chronic diseases once considered diseases of adulthood are increasingly prevalent among youth. The prevalence of type 2 diabetes mellitus, atherosclerotic lesions, and hypertension, conditions linked with poor diet, including inadequate fruit and vegetable intake, continue to rise among adolescents (Pinhas-Hamiel, Dolan, Daniels, Standiford, Khoury & Zeitler, 1996; Soraf & Daniels, 2002; Berenson, Srinivasan & Nicklas, 1998; DHHS, 1996). Eating patterns adopted during childhood track into adulthood (Nicklas et al., 2001; Westenhoefer, 2002; Fischer & Birch, 2001; Mikkila et al., 2005; Singer et al., 1995).

Therefore, it is important to achieve adequate fruit and vegetable intake patterns during childhood in order to establish lifelong intake of these beneficial foods.

In addition to its physiological effects, diet influences psychosocial factors, such as behavior, mood, and academic performance of children. Florence et al. (2008) examined diet quality indices of over 5,000 fifth-grade students. Diet quality scores, and indices of fruit and vegetable intake in particular, were positively associated with standardized literacy assessment scores. Additionally, dietary variety and adequacy were significantly associated with academic performance (Florence, Asbridge & Veugelers, 2008). Kleinman et al. (1998) examined data from the Community Childhood Hunger Identification Project. The data included parental responses to survey questions that indicated both the level of food insufficiency and hunger and the emotional and behavioral symptoms of their child. Children who experienced hunger were significantly more likely to be classified with psychosocial dysfunction, based on a validated Pediatric Symptom Checklist, than children who were not identified as experiencing hunger (Kleinman et al., 1998). In another study, Kleinman et al. (2002) examined students' nutrient intake and academic performance scores before and after participating in a universal school breakfast program (USBP). Students who improved their nutrient intake the most through the USBP showed a significant decrease in reported hunger and absences, and an improvement in mathematics scores (Kleinman et al., 2002). These findings support the concept that sufficient food intake among children, and especially adequate intake of healthy foods such as fruits and vegetables, leads to improvements in multiple aspects of child health and development.

2.1.3 Determinants of Intake and Models of Behavior Change

The determinants of fruit and vegetable intake among children vary. Environmental factors such as access and availability play a role as well as personal factors such as preference and knowledge (Blanchette & Brug, 2005; Brug, Tak, te Velde, Bere & de Bourdeaudhuij, 2008).

Fruits and vegetables are important constituents of a healthy diet; however, many children live in households without reliable and safe access to such foods. In 2009, 17.2 million children lived in food insecure households in the United States. Of the 17.2 million children living in food insecure households, 5.4 million children lived in households with very low food security. In terms of children actually experiencing the effects of household food insecurity, in 2009, 9 million children lived in households in which children directly experienced food insecurity. Of these 9 million children experiencing food insecurity, 988,000 children lived in households in which children directly experienced very low food security (USDA ERS, 2011). The term "Very Low Food Security" recently replaced the term, "Food Insecurity with Hunger". Very low food secure children experience disrupted eating patterns and reduced food intake as a result of not having enough food in the household (USDA ERS, 2011; FRAC 2009). Household food insecurity has been linked with a decreased intake of fruits and vegetables and associated nutrients such as vitamin C and potassium (Kendall, Olson & Frongillo, 1996; Kaiser et al., 2003).

In addition to environmental factors, such as home access to fruits and vegetables, personal and behavioral factors such as individual preference, attitude, behavior, skill, and knowledge influence fruit and vegetable intake (Blanchette & Brug, 2005; Brug et al., 2008; Resnicow et al., 1997; Cullen, Baranowski, Owens, Marsh, Rittenberry & de Moor, 2003).

It is recommended for nutrition educators and researchers to design nutrition intervention programs based on established theoretical models (Contento, 1995a; Contento, 1995b; Contento, 2007). Numerous nutrition interventions, including many GBNE programs, are based on the Social Cognitive Theory (SCT). As described by Contento (2007), the SCT is useful within a nutritional context. The SCT, posits that three main factors, which are reciprocal in nature, work together to influence nutrition-related behavior, including fruit and vegetable intake. Personal factors, such as outcome expectations and self-efficacy; behavioral factors, such as nutrition knowledge and skills; and environmental factors, including external surroundings that cannot be changed or those that can be modified, directly affect each other in a balance known as reciprocal determinism. Together, these factors also influence nutrition behavior (Lytle & Achterberg, 1995; Contento, 2007).

In a study examining the determinants of fruit and vegetable intake of over 1,000 third-grade students, Resnicow et al. (1997) found associations between fruit and vegetable intake and several SCT constructs. Preference and positive outcome expectations were significantly associated with fruit and vegetable intake (Resnicow et al., 1997). Cullen et al. (2003) showed a significant positive association between fruit and vegetable intake and home accessibility and availability among fourth through sixth graders. They also showed a significant positive association between fruit and vegetable intake and preference (Cullen et al., 2003).

Garden-based nutrition interventions, especially those with a goal of increased fruit and vegetable intake, often depend on the SCT as a theoretical framework for intervention planning, implementation and evaluation, proposing that such interventions lead to improved personal, behavioral, and environmental factors with regard to fruit and vegetable intake (Morris Zidenberg-Cherr, 2002; Heim, Stang & Ireland, 2009; Ratcliffe, Merrigan, Rogers & Goldberg,

2009; Morgan, Warren, Lubans, Saunders, Quick & Collins, 2010). Models that include a wide range of behavioral determinants, including individual, environmental, and societal factors, must be considered when working to understand and improve child and adolescent nutrition behaviors (Story, Neumark-Sztainer & French, 2002).

The Knowledge-Attitude-Behavior (KAB) model has also been used as a framework for garden-based nutrition interventions. According to this model, increased nutrition knowledge leads to attitude change, which, in turn, may lead to nutrition-related behavior change. Several recent studies exploring the outcomes of GBNE have applied constructs from the KAB model, although they do not name the model as their theoretical foundation (Somerset & Markwell, 2009; Parmer, Salisbury-Glennon, Shannon Struempler, 2009). As noted by Contento (2007), various types of knowledge, including "*how to*" and "*why to*" knowledge, may be measured using the KAB approach. Understanding the recommendations for intake of a particular food group, being able to decipher the meaning of a food label, or knowing where food comes from, is known as instrumental knowledge, or "*how to*" knowledge. Instrumental knowledge leads to outcome benefits only for individuals who are already interested in and motivated to change their behavior. Understanding *why* fruits and vegetables promote health, what benefit calcium imparts to children and teens, or *why* sweets should be eaten in moderation is known as "*why to*" knowledge (Contento, 2007). Contento posits that "*why to*" knowledge, as opposed to "*how to*" knowledge, leads to changes in attitudes and behaviors because "*why to*" knowledge provides a direct link to consequences of a certain behavior. In other words, "*why to*" knowledge is linked to outcome expectations, which play a role in the SCT and other health behavior theories (Contento, 2007).

2.1.4 Recommendations and Trends

A practitioner searching for precise intake recommendations on which to base a nutrition education program may be surprised at the milieu of overlapping guidelines and recommendations available to the public. With regard to fruit and vegetable intake, however, one piece of advice remains constant: more is better. According to the USDA MyPyramid for Kids (2011), children between the ages of 4 and 18 years should consume between 1½ to 3 cups of vegetables and between 1 to 2 cups of fruit per day. The USDA emphasizes increased vegetable variety, recommending consumption of vegetables from all five subgroups—dark green, orange, dry beans and peas, starchy and other—on a weekly basis (USDA, 2011b). Fruits and vegetables constitute about 1/3 of the area of the MyPyramid for Kids, indicating that these foods should represent a substantial portion of a child's diet.

The USDA and DHHS recently released a revised set of national dietary recommendations- the Dietary Guidelines for Americans: 2010. The recommendations provided in the revised guidelines do not emphasize specific amounts or portions of fruits and vegetables. Rather, the new guidelines simply state that fruit and vegetable intake should be *increased* (USDA, 2010a). The DHHS (2010) also addresses fruit and vegetable intake in Healthy People 2020, a set of national objectives designed to improve the health of all Americans. In this document, Nutrition and Weight Status (NWS) Objectives 2.2 and 15 focus on fruit and vegetable intake. NWS Objective 2.2 falls under the Healthier Food Access category and gives a target of "18.6 percent of school districts requiring schools to make fruits and vegetables available whenever other foods are offered or served." NWS Objective 15 falls under the Food and Nutrient Consumption category and gives a target intake of "0.3 cup equivalents of dark green vegetables, orange vegetables or legumes per 1000 calories for individuals 2 years or

older" (DHHS, 2010b). For the prevention of cancer and other chronic diseases such as diabetes, heart disease and hypertension, the NCI (2010) recommends an intake of 2 to 5 servings of fruits and 2 to 8 servings of vegetables (especially dark green and orange vegetables, and legumes) per day (DHHS, 2010d).

Although agencies from national to local levels continue to promote increased fruit and vegetable intake, national data show that American children consume less than the recommended amounts of these foods (Guenther et al., 2006). According to the 1999-2000 NHANES, fewer than 20% of children aged 4-13 years of age consumed 5 or more servings of fruits and vegetables per day. On average, males aged 9-13 years ate 1.2 servings of fruit and 2.4 servings of vegetables (total of 3.6 servings) per day. Females aged 9-13 years ate 1.3 servings of fruit and 2.5 servings of vegetables (total of 3.8 servings) per day (Guenther et al., 2006). Despite the protective effects of dark green and orange vegetables and legumes against cancer and other chronic diseases, intake of these foods was lacking among children as well. On average, males aged 9-13 years ate 0.1 servings of dark green vegetables and 0.1 servings of orange vegetables per day. The recommended servings per day of dark green and orange vegetables among individuals in this group is 0.9 and 0.6 servings respectively. On average, females aged 9-13 years ate 0.1 servings of dark green vegetables and 0.1 servings of orange vegetables per day. The recommended servings per day of dark green and orange vegetables among individuals this group is 0.6 and 0.4 servings respectively (Guenther et al., 2006).

Given the low level of fruit and vegetable intake among American children, it is not surprising that childrens' intake of nutrients associated with these foods also falls below recommended levels. According to the 1999-2000 NHANES, childrens' intake of numerous

nutrients, including vitamins A and C, and folate did not meet recommendations (Ervin, Wright, Wang & Kennedy-Stephenson, 2004).

2.2 School-Based Interventions

Schools are ideal settings for interventions that promote positive lifestyle choices, including healthy eating and physical activity, among youth (French & Stables, 2003; Briggs & Safai, 2003; Story et al., 2006; Sallis et al., 2003; Lytle et al., 1996; Baranowski et al., 2000a). However, numerous practical challenges exist with regard to implementation and evaluation of school-based nutrition and health intervention programs (Baranowski et al., 2000b; Basch, Sliepcevich, Gold, Duncan & Kolbe, 1985). Successful school-based intervention programs foster acceptance and engagement among key participants and stakeholders, including teachers and administrators. Consistent delivery of intervention components, as well as appropriate monitoring, evaluation and improvement methods are important factors for the success of school-based intervention programs (Basch et al., 1985; DHHS, 2001).

2.3 School Gardens

Due to the importance of fruit and vegetable intake, especially during childhood and adolescence, school garden programs have become a means through which nutrition educators promote fruit and vegetable consumption among youth (Robinson-Obrien et al., 2009). In the following section, the theoretical foundations of garden-based learning, a brief history of school gardens and nutrition outcomes and experiences associated with school gardens will be discussed.

2.3.1 Introduction to Garden-Based Learning

2.3.1.1 Garden-Based Learning and Experiential Education

Gardens provide an opportunity for students to engage in direct, hands-on experiences, a defining characteristic of experiential education. According to the Association for Experiential Education (2011), experiential education leads to increased knowledge and skill development through a process by which students engage in direct experiences (AEE, 2011). John Dewey, an early proponent of experiential education, believed that learning must always be accompanied by hands-on experience and that every learning experience serves as context for future learning experiences (Dewey, 1916; Dewey, 1938).

According to Kolb's (1984) theory of experiential learning, observations and reflections made during experience-based learning lead first to an abstract understanding of the experience at hand, followed by an application of newly understood concepts in novel situations (Kolb, 1984). Therefore, connecting students with hands-on learning experiences, garden-based education may have the ability to foster a process through which abstract ideas become tangible and are applied beyond the original learning setting. Kolb also explained that learning is a reciprocal process through which the learner is influenced by the environment and the environment is in turn influenced by the learner (Kolb, 1984). This concept, also known as reciprocal determinism, is a key component within several models of behavior change, including the Social Cognitive Theory and the Social Ecological Perspective (Contento, 2007; Story et al., 2002).

Carver (1996) explains that experiential education involves integrating students' experiences into curriculum and that experience includes a combination of senses, emotions,

physical condition and cognition (Carver, 1996). By establishing an environment through which students may engage in experience-based education, educators enhance the physical and social context for learning. Contextualized learning leads to several student-level outcomes: (1) personal agency, (2) a sense of belonging, and (3) competence (Carver, 1996). Personal agency, as described by Carver, is similar to the Social Cognitive Theory's concept of self-efficacy, described in a nutritional context by Contento (Contento, 1995). Competence is similar to the concept of behavioral factors included in the Social Cognitive Theory. Such behavioral factors include knowledge and behavioral skill (Contento, 1995). In light of these similarities, experiential education influences student behavior through processes that span theoretical boundaries.

Experiential education has been shown to impart a host of positive outcomes with regard to standards-based academic performance. In a study exploring the outcomes of environmental education, a type of experiential education, Liberman and Hoody (1998) demonstrated that students who engaged in hands-on learning exhibited improved performance in reading, writing, mathematics, science and social studies. Students also exhibited a sense of pride and ownership in their work, which led to personal empowerment and investment in their communities (Liberman & Hoody, 1998).

2.3.1.2 Garden-Based Learning and the Importance of Place

Garden-based learning, a form of environment-based experiential education, nurtures a developing sense of place among students (Thorp, 2006). By developing an understanding of and appreciation for place, or one's natural environment, a learner also develops a context through which to interpret and apply abstract concepts introduced in the traditional classroom setting

(Orr, 1992). The exploration of one's environment is a multi-disciplinary experience. Nature does not subdivide itself by discipline; therefore, an exploration of one's natural environment leads to an educational experience that transcends curricular boundaries (Orr, 1992; Sobel, 2004; Thorp, 2006). In light of the place-based nature of garden-based education, it is not surprising that gardens offer opportunities for academic instruction across the curriculum (Graham et al., 2005a; Graham & Zidenberg-Cherr, 2005b; Thorp, 2006).

In her account of a Midwestern school's experience with a garden, Thorp (2006) explained that children at the school lacked a connection to place:

> Largely, these children were dis-placed people, through no fault of their own, never able to truly inhabit a place. They did not have access to nature, nor were they given the freedom and time to 'soak in a place' as Paul Shepard (1977) says is so necessary for healthy human development. (Thorp, 2006, p. 38)

Thorp went on to explain that the school garden provided an opportunity for experiential learning to children who lacked experiences in the natural world.

> For the children of Jonesville School, the garden provided a complex, living environment, ripe for experiential learning. The teachers often stressed the importance of the garden as a space for children to expand their life experiences, a place to interact with nature increasingly absent in their lives. (Thorp, 2006, p. 49)

The efficacy of gardens as a means to deliver nutrition education, and in turn, effect behavior change, may stem from the experiential and place-based nature of learning that occurs in the garden.

2.3.2 Green Spaces, Gardens and Interpersonal Relationships

Green spaces, including garden environments, can have a powerful effect on interpersonal relationships. The presence of trees and vegetation has been shown to increase direct interactions between youth and adults because high levels of vegetation increase the likelihood of a space being jointly occupied by children and adults (Coley, Sullivan & Kuo, 1997). Children who play in spaces with high levels of vegetation are twice as likely to have access to adult attention than children of similar demographics who play in barren spaces (Taylor, Wiley, Kuo & Sullivan, 1998). In a study conducted among community gardeners in Flint, Michigan, gardens had a positive effect on intergenerational relationships and peer relationships between youth (Ober Allen, Alaimo, Elam & Perry, 2008). A compelling outcome noted in the Flint study was the community garden's ability to shift adult perceptions about spending time with youth. The garden served as a liaison, facilitating interaction between neighborhood youth and adults who previously may not have been interested in such interactions (Ober Allen et al., 2008).

2.3.3 Gardens in Schools

2.3.3.1 History of School Gardens

Support for gardens in schools is not a new concept. Scholars and practitioners across disciplines support the use of gardens in education. Erasmus Schwab, a late nineteenth century Austrian philosopher and educator, believed that school gardens fostered practical and intellectual curiosity in learners:

> A judicious and well planned school garden will surely solve an essential part of the problem of the people's education, and help to educate an intelligent and circumspect working power, which, accustomed to ask the *what* the *how* and the *why* upon every subject, will cultivate a correct judgment upon those things and relations in life with which they have to do. (Schwab, 1879, p. 25)

In the early 1900's, shortly after the widespread establishment of school gardens in Europe, school gardens in the United States gained increasing popularity. Fannie G Parsons, an early supporter of school gardens worked to establish the De Witt Clinton School Farm, in west Manhattan, New York. She explained that the garden filled a gap in experience for urban children: "City children are enclosed amid bricks, stone, concrete, trolleys, trucks, and automobiles; and are therefore 'alienated' from their human birthright of trees, fields, and flowers" (New York City Department of Parks and Recreation, 2011; Parsons in: Carter, 2010).

Figure 1. Children at the De Witt Clinton School Farm, circa 1902 (New York City Department of Parks and Recreation, 2011)

The similarities between observations made by Schwab and Parsons, early supporters of school gardens, and contemporary supporters of experiential, place-based learning, including Kolb, Carver, Orr, Sobel and Thorp, give rise to the notion that school gardens and environment-based education carry with them a sort of timelessness, with benefits that reach across cultures and span generations.

In 1914, the United States government created the Office of School and Home Gardening, part of the United States Bureau of Education. The wartime experience led to further national support for school gardens. The United States School Garden Army was established during WWI with a goal of increasing food production and conservation and "to help in the World War and world peace" (Hayden-Smith, 2006; Carter 2010).

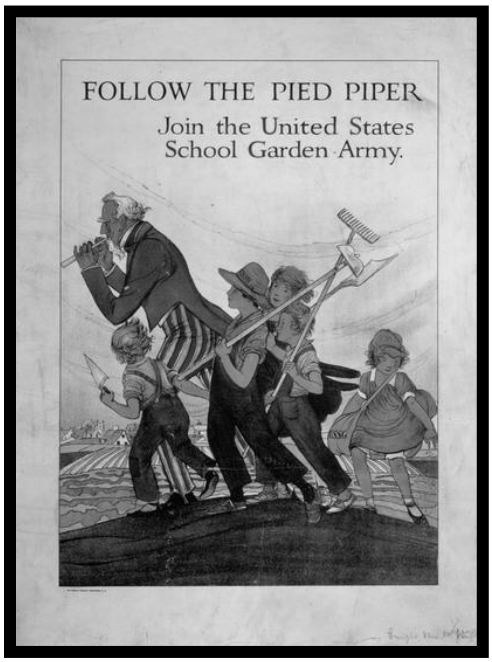

Figure 2: Poster promoting the United States School Garden Army, circa 1919? (Barney, M. W. E.)

Figure 3: Children and their teacher in a school victory garden in New York, NY. circa 1944 (Meyer, ca. 1944)

Today, the popularity of school gardens continues to grow (Robinson-Obrien et al., 2009). According to Constance Carter (2010), the head of the science reference section at the Library of Congress, between the years 2000 and 2010 the number of requests by educators for materials on school gardening increased eightfold (Carter, 2010).

2.3.3.2 School Gardens Today

A resurgence of school gardening in the United States began during the environmental movement of the 1970's and led to a state-by-state approach to support for gardening in schools. California, one of the first to promote school gardens at the statewide level, provided start-up funds in the late 1990's to help interested schools establish gardens (Ozer, 2007; Blair, 2009). Since then, educators in California and other states have integrated gardening into core curricular subject areas as well as nutrition education, school food production and extracurricular activities

(Graham et al., 2005a; Graham & Zidenberg-Cherr, 2005b; Ozer, 2007; Blair, 2009; National Gardening Association, 2011).

In a study conducted among school principals from California, Graham et al. (2005a) found that gardens were used predominantly in K-8 schools. Within these schools, gardens were used most frequently for academic instruction and extracurricular activities. According to the study participants, science, environmental studies and nutrition were the subjects most commonly taught through the use of school gardens (Graham et al., 2005a). The principals reported that schools lacked resources linking garden-based learning to mandated curriculum and that schools lacked GBNE curricula. For schools without gardens, lack of funding and lack of time for garden-based education were the most significant barriers to having a school garden (Graham et al., 2005a).

Graham and Zidenberg-Cherr (2005b) conducted an additional survey among fourth-grade teachers in California to assess use of school gardens and to understand teachers' attitudes about school gardening. According to the teachers, the most common reason for having a school garden was academic instruction. Science, nutrition, environmental studies, language arts, mathematics and agricultural studies were the most frequently taught subjects (Graham & Zidenberg-Cherr, 2005b). Teachers also believed that school gardens enhanced learning of social skills. Teachers' perceived barriers to having or using school gardens were lack of time, lack of interest or experience, and lack of resources linking garden-based learning with mandated curriculum. Teachers also indicated that access to garden-based nutrition curricula would facilitate their use of gardens in academic instruction (Graham & Zidenberg-Cherr, 2005b).

In Michigan, many school and community garden-based educators and researchers also perceived a deficit in resources linking nutrition and core curricular subjects to garden-based

learning (Scott, 2011). The evident need for concrete links between curricular subject instruction, nutrition education and garden-based learning led to a systematic review and compilation of existing garden-based curricula (Scott, 2011). This compilation, now known as MyGarden™, links individual garden-based lessons with core curricular subject areas by grade level. MyGarden™ also provides a description of key characteristics of lessons in existing garden-based curricula, including lesson objectives, intended grade level and group size, seasonality, indoor vs. outdoor and whether the lesson promotes USDA SNAP-Ed key behavioral outcomes. The key behavioral outcomes associated with USDA SNAP-Ed funding include: adequate intake of fruits and vegetables, whole grains and low fat or fat free dairy products every day; balancing energy intake with energy expenditure; and engaging in daily physical activity as part of a healthy lifestyle (USDA, 2010). Development of a resource linking existing garden-based curricula and the Michigan Grade Level Content Expectations (GLCE's) is also underway. Tables 1 and 2 provide examples of information included in the MyGarden™ review. Several of the curricula included in the MyGarden™ review, including the example provided in Table 2, are currently in use by the one of the school garden programs included in this case-study.

Educators seeking innovative strategies for teaching mandated curricular subjects in ways that enhance deep meaningful learning may be attracted to the potential academic, social and personal benefits that accompany garden-based learning in schools. School gardens have been linked with improved academic achievement scores in science and increased student interest in learning across curricular subjects (Canaris, 1995; Klemmer, Waliczek & Zajicek, 2005; Dirks & Orivs, 2005).

Table 1. My Garden™ Lesson Titles, Subjects Covered and Grade Level (Adapted from Scott, 2011)

Grade Level	Lesson Title	Subject
Kindergarten	The Healthy Alpha-Garden	English and Language Arts
1	Carrot Fun	English and Language Arts
2	Follow the Drinking Gourd	English and Language Arts
Kindergarten	Shape Garden	Math
1	Graphing Garden	Math
2	Cool Beans!	Math
Kindergarten	Square Foot Garden	Science
1	Healthy Beans	Science
2	Wonder Garden of Health	Science
Kindergarten	The Giving Garden	Social Studies
1	Garden Map	Social Studies
2	GWC, Master Gardener	Social Studies

Table 2. My Garden™ Nutrition Resource and Lesson Review (Adapted from Scott, 2011)

Resource Title	Nutrition to Grow On
Lesson Title	Nutrients We Need
Page	27
Lesson Objective (as stated)	Emphasize the similarities between humans and plants in their need for nutrients, learn about classes of nutrients, learn how to identify good food sources of nutrient, how plants provide us nutrients, and vermicomposting.
Target Age/Grade Level	4^{th}-6^{th} grades
Group Size	10-20 or 20-40
Prep Time	1 hr +
Required Background/Information Provided?	Yes
Specialty Materials Required	Worm bin or similar substitute
Region Climate Bias	None
Season	Spring, Summer, Fall, Winter
Indoor or Outdoor	Indoor
Assessment Tools Included	Yes - Quiz
Suggestions or Adaptations for English Language Learners	No
Suggestions or Adaptations for Special Education	No
Worksheets Provided	Yes
Garden Based/Food Based/Physical Activity Based	Garden Based, Food Based
Lesson Promotes these USDA SNAP Ed Concepts	Eat Fruits and Vegetables, whole grains, and non-fat or low-fat milk or milk products every day
Behavior Change/Skill Development/Increased Knowledge	Skill Development, Increased Knowledge

2.3.4 Garden-Based Nutrition Education - Nutrition Outcomes Overview

The peer-reviewed body of literature exploring the nutrition-related outcomes of GBNE is growing. Findings indicate that in-school and extracurricular GBNE improves students' nutrition knowledge, skills, attitudes and behavior, as well as the school environment, with regard to vegetables and fruit. The Social Cognitive Theory and the Knowledge-Attitude-Behavior models are commonly used to guide implementation and evaluation of GBNE programs (Morris & Zidenberg-Cherr, 2002; Heim et al., 2009; Ratcliffe et al., 2009; Morgan et al., 2010; Contento, 2007; Somerset & Markwell, 2009; Parmer et al., 2009).

Despite promising results, intervention studies involving school gardens have encountered challenges in implementation and evaluation. Challenges include inconsistent nutrition lesson content and dose, teacher and staff participation, and adherence to intervention activities (McAleese & Rankin, 2007; Somerset & Markwell, 2008). These challenges are not uncommon to health and nutrition intervention studies conducted in schools (Baranowski et al., 2000b; Basch et al., 1985). Since teacher and other school staff participation are variables that may influence the content, dose and long-term sustainability of a school GBNE program, researchers and practitioners must work to understand the expectations and attitudes of these participants during each step of the school garden planning and implementation process.

Limited duration of study implementation also poses a challenge to school garden-based intervention studies (McAleese & Rankin, 2007; Somerset & Markwell, 2008; Parmer et. al, 2009; Ratcliffe et al., 2011; Morgan et al., 2010). Studies that focus on extended exposure to school GBNE may provide more meaningful results.

2.3.4.1 Nutrition Outcomes – Knowledge and Attitudes

A growing body of literature suggests that GBNE leads to increased preference for and knowledge of fruits and vegetables among children. Lineberger & Zajicek (2000) implemented a garden-based nutrition curriculum with third- and fifth-grade students at five elementary schools in Texas. Teachers at the five intervention schools were responsible for implementing the curriculum, consisting of 10 units with 34 total activities. Fruit and vegetable preference were measured using a validated fruit and vegetable preference questionnaire. After participating in the intervention, students' vegetable preference scores significantly increased compared to pre-test scores ($p<0.05$) and students were more likely to choose a fruit or vegetable snack ($p<0.05$) (Lineberger & Zajicek, 2000). Fruit preference did not change after the intervention; however students' fruit preference was high at pretest, possibly explaining the lack of improvement. The lack of a control school was a limitation of the study. The presence of a true control (no intervention) and a control for gardening (nutrition education with no garden) would have strengthened the results. However, as an early contribution to the literature on nutrition outcomes of school gardens, the study provided a useful guide for further research (Heim et al., 2009; Parmer et al., 2009; Morgan et al., 2010).

In a second study, conducted by Morris & Zidenberg-Cherr (2002), students from a control school, students from a school where classroom-based nutrition lessons were delivered (NL), and student from a school where garden-based nutrition lessons were delivered (NL+G) were compared. The lessons taught at the NL and NL+G schools were identical, with the presence of a school garden as the only experimental difference between the two intervention schools. Lessons were delivered by a study investigator and nutrition knowledge and vegetable preference were measured pre- and post-intervention using a nutrition knowledge questionnaire

and a vegetable preference survey (Morris& Zidenberg-Cherr, 2002). After intervention, post-test preference scores for carrots and broccoli (common vegetables) at the NL and NL+G schools were significantly higher than post-test preference scores for those vegetables at the control school ($p<0.05$). Post-test preference scores were not significantly different between the NL and NL+G schools for carrots and broccoli, indicating that participation in garden-based lessons did not lead to an additional increase in preference for carrots and broccoli, beyond the effects of the indoor lessons. The results differed, however, for student preference for less common vegetables; post-test preference scores for zucchini and snow peas at the NL+G school were significantly higher than post-test preference scores at both the NL and control schools (Morris & Zidenberg-Cherr, 2002). These results suggest that participation in GBNE may lead to increased vegetable preference for vegetables that are less commonly encountered by children. A strength of this study was the presence of an overall control school and a school that received nutrition lessons with no gardening.

In a study conducted by Somerset & Markwell (2008), a historical control study design measured outcomes of integrating a school garden into regularly scheduled classroom lessons. After one year of weekly gardening activities, students were better able to identify 21 out of 30 fruits and vegetables (p-values ranged for the 21 individual fruits and vegetables between $p<0.05$ to $p<0.001$). Based on responses to an "attitudes questionnaire", it was determined that participation in garden-based learning significantly increased 4^{th}-6^{th} grade students taste preference for vegetables. In addition, 5^{th}-7^{th} grade students showed a significant shift in subjective norm regarding peer consumption of fruits and vegetables (Somerset & Markwell, 2008).

Several additional studies link school GBNE with improvements in nutrition knowledge and preference for fruits and vegetables among children. In a study comparing students who received garden-based nutrition lessons (NL+G), classroom-based nutrition lesson (NL), and no nutrition lessons, Parmer et al. (2009) showed that fruit and vegetable identification increased for students in both intervention groups (Parmer et al., 2009).

In a quasi-experimental, 10-week, garden-based nutrition intervention study, Morgan et al. (2010) compared students from a control school to students from an intervention school. Students at the intervention school were subdivided into two groups: garden-based nutrition education (NL+G) and classroom-based nutrition education (NL). Students from the NL+G group were better able to identify vegetables after the intervention than students from the NL and control groups ($p<0.001$). A similar treatment effect was found for willingness to try several vegetables: peppers ($p=0.04$), broccoli ($p=0.01$), tomato ($p<0.001$), and pea ($p<0.001$); in addition to students' preference to eat broccoli and peas as a snack ($p<0.001$) (Morgan et al., 2010).

In a final study, conducted by Ratcliffe et al. (2011), students from two schools with gardens were compared with students from a control school. The intervention consisted of four months (13 hours total) of garden-based lessons integrated into regularly scheduled science lessons. After the four month intervention period, students from the intervention schools were significantly more likely to properly identify vegetables than students from the control school ($p=0.002$) (Ratcliffe et al., 2011). In addition to an increase in knowledge (vegetable identification), participation in garden-based learning was associated with a significant increase in preference for vegetables, in general ($p=0.029$) and for the specific kinds of vegetables grown in the garden ($p=0.017$). These studies provide compelling evidence identifying school gardens

as a means to improve students' nutrition-related knowledge and attitudes, especially with regard to fruit and vegetable identification and preference for vegetables.

2.3.4.2 Nutrition Outcomes – Behavior

Current use of gardens in schools can be attributed, in part, to their ability to promote healthy eating among students. Until recently, much of the evidence supporting this benefit has been anecdotal, with a paucity of peer-reviewed literature to accompany claims of behavior change (Robinson-Obrien et al., 2009). Within the past decade, however, numerous studies have examined behavioral outcomes of school gardening. These studies suggest that school garden-based nutrition interventions improve students' fruit and vegetable intake (Herman et al., 2006; McAleese & Rankin, 2007; Heim et al., 2009; Parmer et al., 2009; Ratcliffe et al., 2011).

Students' self-described vegetable intake was assessed by Hermann et al. (2006) in a study that utilized a pre-test - post-test, nonrandomized design. Before and after the implementation of an after-school GBNE program, students were asked to respond to the following statement: "I eat vegetables every day," with "yes", "sometimes," and "no" as response options. After participating in the intervention, the number of students who reported eating vegetables every day significantly increased ($p<0.02$) (Hermann et al., 2006).

McAleese & Rankin (2007) compared students from a control school, students from a school receiving nutrition lessons only (NL), and students from a school receiving nutrition lessons with hands-on garden experience (NL+G). Food intake was measured pre- and post-intervention via repeated 24-hr recall workbooks. The workbooks were administered by classroom teachers who had received standardized training for administering the recalls (McAleese & Rankin, 2007). The recalls were analyzed for daily servings of fruits and

vegetables and daily intake of vitamins A, C, and fiber. Students who participated in hands-on gardening (NL+G) significantly increased their intake of fruits ($p<0.001$), vegetables ($p<0.001$), vitamins A ($p=0.004$), C ($p=0.016$), and fiber ($p=0.001$) compared with students who received classroom-based nutrition lessons and students from the control group.

In a study conducted by Parmer et al. (2009), nutrition outcomes of a 28-week garden-based nutrition intervention were measured among students within one school. Three groups of second-graders were assigned, by class, to a control group, nutrition lessons only group (NL), and a nutrition lessons with gardening group (NL+G). Six classes, two classes in each group, participated. Both intervention groups received the same lessons from existing nutrition curricula. Therefore, the only experimental difference between the two intervention groups was the integration of hands-on garden activities (Parmer et al., 2009). Fruit and vegetable intake was measured via lunchroom observation. This method involved the investigator recording what type of lunch each student selected (school lunch, grab-and-go, or home lunch), what vegetable items were selected, and whether students' consumed the majority of the vegetables in their lunches. Students who participated in hands-on gardening increased their selection of vegetables from the school lunch ($p<0.01$) between pre-test and post-test compared with students who received only nutrition lessons and control students (Parmer et al., 2009). This study is unique in that it is the only study, to date, using lunchroom observation to measure vegetable intake as an outcome of school gardening.

In a pre-test – post-test design, nonrandomized study conducted by Heim et al. (2009), 4^{th} through 6^{th} grade students engaged in GBNE at an extra-curricular summer camp. Following the twelve week intervention, students reported an increase in the number of vegetables ever

eaten ($p<0.001$) and in the number of fruits ever eaten ($p<0.02$). Students home asking behavior for fruits and vegetables also increased ($p<0.002$) post intervention (Heim et al., 2009).

Ratcliffe et al. (2011) also examined fruit and vegetable intake as an outcome of school gardening. At two garden-based intervention schools and one control school, a taste test questionnaire and validated Garden Vegetables Frequency Questionnaire (GVFQ) were used to assess variety of vegetable consumption (Ratcliffe et al., 2011). According to the GVFQ, students who participated in the garden significantly increased the variety of vegetables consumed more than once a month, both for vegetables grown in the garden ($p=0.005$) and vegetables not grown in the garden ($p=0.001$), compared with the control group. Additionally, according to the taste test questionnaire, students who participated in the garden significantly increased the variety of vegetables eaten at school compared with students who did not participate in the garden ($p=0.01$) (Ratcliffe et al., 2011).

These findings indicate that school gardens impart positive outcomes on eating behaviors of children.

2.3.5 Qualitative Exploration of School Gardens

Qualitative studies provide a nuanced understanding of the school garden experience. While fruit and vegetable intake or nutrition knowledge may be measured using quantitative questionnaires and surveys, the day to day joys and frustrations associated with school gardening are more difficult to assess using quantitative methods. A multiple-choice survey cannot record the expression that flashes across a child's face after she tastes her first radish, still cool from the dirt, and realizes that she wants more. Quantitative instruments overlook the calm that settles over a classroom of rowdy first-graders as they sit in the October sun and harvest basil seeds

from brittle pods. These valuable data must be considered in order to fully understand the experience and impact of school gardens.

Several qualitative studies provide insight on the benefits and challenges associated with school gardening. Alexander et al. (1995) described the benefits of an elementary school garden in Texas. Benefits included moral development, academic learning, parent/child/community interaction, pleasant experiences and the influence of the Master Gardener. Teachers, the school administrator and parents supported the school garden because of its ability to motivate students to attend school and to learn. The garden also enriched students' school experience by bringing caring non-related adults into the school (Alexander, North & Hendren, 1995). Lack of time was mentioned as a barrier to school gardening. This barrier appears throughout the literature (Graham et al., 2005a; Graham & Zidenberg-Cherr, 2005b).

Canaris (1995) described the outcomes of an elementary school garden in Vermont. Her report is unique in that Canaris was a teacher from the school. Canaris provided a rich description of the development and evolution of her school's garden (Canaris, 1995). The garden program was established in response to a parent's concern about unhealthy snacks offered at the school. The concerned parent, also a local farmer, was motivated to help the school establish a garden, not only to promote healthy eating among students, but also to instill in the children a sense of respect for and understanding of agriculture (Canaris, 1995). The garden was integrated into academic instruction; however the main focus of the school garden was the experience of growing, processing, and eating healthy food. In the fall of the garden's first growing season, students and parents canned 85 pints of dilly beans; and an in-class crock style pickling project became a tradition for the students. After participating in processing food from the garden, students decided to write to local businesses, requesting donations of healthy foods to

complement their garden produce. Lessons from the garden expanded well beyond a place to grow and eat fruits and vegetables. Here, the garden served as a contextual learning experience through which the students developed writing and communication skills (Canaris, 1995). Scientific inquiry was also a component of the garden experience. Exercises in hypothesis development and testing accompanied these hands-on learning opportunities. Children, teachers, parents and community members shared a sense of pride and ownership in the school's garden (Canaris, 1995).

Thorp (2001) studied an elementary school's experience with a garden in the Midwest. The goal of her research, a participatory ethnography, was to understand the impact of an agricultural education-based school garden on students' relationship with food and nature. An additional goal of the study was to explore the impact that the garden had on teachers' ability to engage students in the learning process. Thorp employed a naturalistic approach to recursive data collection and analysis (Thorp, 2001).

Recognized by students as "The Garden Lady," Thorp described a state of grace and gratefulness and a communal sense of pride and identity born from the garden. The garden also fed the creative energy of students and teachers. Thorp described teachers' assertion that true structured learning was difficult to plan and achieve and that often, the most meaningful learning opportunities presented themselves spontaneously, described as "planning in the doorway" (Thorp, 2001, p. 354). Thorp found that teachers valued the garden because it allowed them to make cross-curricular connections. She described a disconnect between the garden and rigid academic boundaries, "I have come to believe that the garden is a portal through the confines of disciplinarity. Corn seeds, ladybugs, children and pumpkins know nothing of these artificial confines" (Thorp, 2001, p. 355).

Perhaps the most pertinent observation to the data that will follow in this thesis was Thorp's description of students' lack of experiences and the role that the school's garden played as a portal to life experiences, especially experiences with nature (Thorp 2001). Teachers saw the garden as a place where children could interact with nature, an experience otherwise lacking in the children's' lives. Additionally, the garden was a means through which the students interacted with a caring adult, an adult with whom the students did not associate the rigid structure of schooling (Thorp, 2001).

The studies conducted by qualitative researchers are important because they allow for emergent theme development, providing results that cannot be explored using pre-determined survey questions. The recursive process involved in naturalistic inquiry allows the researcher to adapt questions based on the emergence of new ideas from the data (Lincoln & Guba, 1985).

In a review of the qualitative school garden literature, Blair (2009) describes seven themes that were common to the majority of studies: (1) students were excited about and enjoyed gardening; (2) students had pride in the garden and parents became involved with the garden; (3) the gardens promoted community-building and outreach, teamwork, student bonding, and adult interaction; (4) the gardens promoted cross-curricular learning, especially in environmental stewardship, mathematics and science; (5) students learned about nutrition and food systems through cooking and eating food and through providing food to others in the community; (6) school gardens allowed students to experience nature in an unstructured way; and (7) dedicated garden champions were required for the gardens to succeed (Blair, 2009). Several quantitative studies, mentioned in previous sections of this chapter, reported outcomes that mirrored outcomes of the qualitative studies described by Blair. Such outcomes included curricular integration and academic achievement, food preference and intake and barriers and facilitators to

having or using school gardens (Graham et al., 2005a; Graham & Zidenberg-Cherr., 2005b; Dirks & Orvis, 2005; Lineberger & Zajicek, 2000; Morris & Zidenberg-Cherr, 2002; Hermann et al., 2006; McAleese & Rankin, 2007; Somerset & Markwell, 2008; Heim et al., 2009; Parmer et al., 2009; Morgan et al., 2010; Ratcliffe et al., 2011). The qualitative and quantitative bodies of literature exploring school gardens complement each other and provide compelling support for the use of gardens in schools.

CHAPTER 3

Lessons from the Garden: Perceived Outcomes of School Garden-Based Nutrition Education at Two Elementary Schools

ABSTRACT

Background: School gardens have been shown to improve nutrition-related outcomes and academic performance, promote development of interpersonal skills, and facilitate peer and intergenerational relationship building. Until now, a comprehensive model describing the numerous outcomes of GBNE and how these outcomes work together to influence fruit and vegetable intake among students has not been proposed. This study explored perceived outcomes associated with GBNE at two elementary schools in the Midwest and proposed a model for the effect of GBNE on students' fruit and vegetable intake.

Methods: A case-study approach was employed to explore outcomes associated with gardens at two elementary schools in the Midwest. Semi-structured interviews were conducted with adults at the two schools. Participant observation among adults and children was conducted and field notes were recorded. Student work was also collected. Interview transcripts, field notes and student work were coded and analyzed using a grounded-theory approach, and emerging themes were identified. This paper discusses findings identified within the theme – outcomes associated with school GBNE. A conceptual model explaining the impact of GBNE on students' fruit and vegetable intake was developed after numerous individual outcomes associated with GBNE were identified.

Results: Seven perceived positive outcomes were associated with GBNE: (1) enhanced nutrition knowledge, attitudes and behaviors, (2) improved understanding of food systems, (3) enhanced school learning experience, (4) character development, (5) enhanced life experience, (6) intergenerational relationships and community engagement, and (7) feelings of enjoyment,

wonder and therapeutic effects among students and staff. The seven outcomes were incorporated into a conceptual model that explains GBNE's unique ability to improve students' fruit and vegetable intake.

Conclusion: Children and adults experienced positive outcomes associated with school GBNE. These outcomes did not occur in isolation of one another. An understanding of the relationship between the multiple positive outcomes of school gardening may provide insight into the mode through which gardens foster improvements in nutrition-related outcomes among students.

Keywords: school garden; elementary school; nutrition education

3.1 Background

Poor diet, and in particular, inadequate fruit and vegetable intake can lead to impaired health, growth and development during childhood (Nicklas & Johnson, 2004; DHHS, 1996). Health conditions linked with poor diet and inadequate fruit and vegetable intake, such as atherosclerotic lesions and hypertension, are increasingly prevalent among youth (Soraf & Daniels, 2002; Berenson et al., 1998). Data from the 1999-2000 National Health and Nutrition Examination Survey indicate that fewer than 20% of children aged 4-13 years of age, consumed 5 or more servings of fruits and vegetables per day (Guenther et al., 2006).

Several theoretical models describe factors that impact fruit and vegetable intake among children. The Social Ecological Model and the Social Cognitive Theory, in addition to the Knowledge-Attitude-Behavior Model address personal, social, and environmental factors that impact eating behavior (Story et al., 2002; Contento, 2007). Studies exploring constructs included in these models have shown that preference, peer interaction, modeling, exposure, availability and access, outcome expectations, self-efficacy and knowledge of recommendations

play a role in determining fruit and vegetable intake among children (Birch & Fisher, 1998; Kristjansdottir, Thorsdottir, De Bourdeaudhuij, Due, Wind, & Klepp, 2006; Reynolds, Hinton, Shewchuk & Hickey, 1999; Brug et al., 2008; Resnicow et al., 1997; Domel , Baranowski, Davis, Leonard, Riley & Baranowski, 1993; Domel, Thompson, Davis, Baranowski, Leonard & Baranowski, 1996; Cullen et al., 2003).

The impacts of GBNE have been studied and described within the context of several of these theoretical constructs, including the garden's effect on preference for and knowledge of fruits and vegetables. School gardening has been shown to improve students' knowledge, skills, attitudes and behaviors regarding fruit and vegetable consumption (Hermann et al., 2006; McAleese & Rankin, 2007; Morris et al., 2000; Morris & Zidenberg-Cherr, 2002). GBNE also allows educators to promote hands-on nutrition education while meeting mandated curricular teaching requirements (Graham et al., 2005a; Graham & Zidenberg-Cherr, 2005b; Canaris, 1995). The effects of school gardening reach beyond the realms of nutrition education and academics – gardens have been found to enrich both student and staff intra- and interpersonal experiences in schools (Blair, 2009; Thorp, 2001; Alexander et al., 1995).

Although nutrition, academic and interpersonal outcomes associated with school gardening have been described as they relate to Social Cognitive Theory, Social Ecological Model, or Knowledge-Attitude-Behavior Model constructs individually, a model depicting how these outcomes work in unison to increase fruit and vegetable intake among students has not been proposed.

This article describes numerous interconnected outcomes associated with school GBNE at two elementary schools in the Midwest. Semi-structured interviews, participant observation and collection of student work were analyzed in order to answer the following questions:

1. How do administrators, staff, and students experience school gardens?
2. What roles do gardens play in schools?

The most common outcome associated with school gardening in this study, hands-on experiential learning, introduced a novel perspective on how garden-based learning improves fruit and vegetable intake among students. Based on this finding, a grounded-theory conceptual model explaining the garden's ability to promote behavior change among students was created. In order to create the grounded-theory conceptual model, first, an integrated theoretical model explaining established determinants of fruit and vegetable intake among children was developed (Figure 4). Next, a data driven model depicting the outcomes associated with GBNE was created (Figure 5). And finally a grounded-theory conceptual model was developed based on the theoretical model and the data driven model (Figure 6). The conceptual model proposes specific, testable, pathways through which GBNE improves students' fruit and vegetable intake.

3.2 Methods

3.2.1 Study Design

A case-study approach based in grounded-theory was used (Yin, 2003; Stake, 1995; Corbin & Strauss, 1990). In his text on case-study research design and methods, Yin (2003) explains that case studies are useful for "investigating a contemporary phenomena within its real-life context especially when the boundaries between phenomenon and context are not clearly evident" (Yin, 2003, p. 13). Two schools, or multiple cases, were included in the study in order to obtain robust data (Herriott & Firestone 1983). The schools in this case-study were not intended to represent an entire population, and therefore, traditional "sampling" methods were not utilized (Stake, 1995). For case studies, the term replication logic is used rather than

sampling. For cases in which similar results are predicted, a literal replication logic is utilized. Literal replication includes 2 to 3 cases which are similar in nature (Yin, 2003).

Two elementary schools, Janesville Elementary and Gilsonville Elementary, were selected based on convenience and to meet the criteria for maximum variation purposive sampling, or replication (Creswell, 2007). Criteria for inclusion were: (1) presence of an established garden program, (2) USDA Supplemental Nutrition Assistance Program Education (SNAP-Ed) grant funding, and (3) proximity to the research institution. Purposive variation at the school level included: (1) percent of students eligible for SNAP benefits, (2) geographic and community characteristics and (3) ethnic composition of the schools. Within the two schools, participants were selected based on willingness to participate in semi-structured interviews, classroom observation and spontaneous dialogue with the researcher.

3.2.2 Sample and Data Collection

The school principals at Janesville and Gilsonville were contacted and were provided a description of the study. Both agreed to have their school participate and letters of support were obtained. USDA SNAP-Ed grant-funded nutrition educators at both schools were identified as primary contacts (USDA, 2010). The nutrition educator at Janesville was a full-time school employee and the nutrition educator at Gilsonville was an employee of an outside community-based organization that facilitated the school's garden program. Primary contacts assisted in the recruitment of participants. Word of mouth and printed invitations were used for recruitment. Table 3 provides a description of the schools and individual participants involved with the study. Data collection included: (1) conducting adult interviews, (2) conducting participant observation with students and adults, and (3) collecting student work. Interviews and participant observations

were conducted by one researcher. Audio recordings of the interviews were transcribed verbatim, proofread and coded by the researcher. The interview process lasted seven months and the participant observation process lasted three months.

3.2.3 Interviews

Interview guides were developed based on a review of literature and findings from a round-table discussion of school and community garden-based nutrition educators (Robinson-O'Brien et al., 2009; Graham et al., 2005a; Graham & Zidenberg-Cherr, 2005b; Blair, 2009; Thorp, 2001; Alexander et al., 1995; Canaris, 1995; Scott, 2011). Specific guides were developed for teachers who were engaged in the garden, teachers who were not engaged in the garden, administrators, food service staff and custodial staff. The guides were reviewed by experts in school and community nutrition and in teacher/researcher collaborative relationships, as well as two classroom teachers not affiliated with either of the schools, but who worked with schools of similar demographics in the region.

The interview guides consisted of open-ended questions designed to draw out rich descriptions of participants' perceptions of and experiences with school GBNE. Four question categories were covered in each interview guide: (1) overall knowledge of and experience with the garden, (2) knowledge of and experience with garden funding, (3) knowledge of and experience with school policies that impact the garden, and (4) perception of school-wide acceptance of and support for the garden. Within each question category, one or two open-ended questions were asked, followed, if necessary, by probing questions designed to draw out specific details of the school garden experience. Table 4 provides an excerpt from the interview guide

used with the school principals. Interviews were conducted face-to-face and were audio recorded.

Interview participants received a $15 gift card as compensation for their participation. Written, informed consent was obtained from all interview participants. Interviews were conducted in English and most lasted between 30 and 45 minutes, with the longest interviews lasting almost 90 minutes.

3.2.4 Participant Observation

Participant observation was conducted at both schools by the researcher. At Janesville, students participated in a weekly Nutrition special (NS), similar in structure to other specials such as art class or music class. The NS was taught by a full-time nutrition teacher and included indoor nutrition lessons, indoor cooking activities and outdoor gardening activities. NS time at Janesville was considered release time for classroom teachers. Therefore, classroom teachers were not included in participant observation at Janesville. Students from every classroom at Janesville participated in the one-hour NS class once per week. The researcher selected three fifth-grade classes, one first-grade class and one kindergarten class with which to conduct participant observation. These classes were selected based on convenience (school scheduling) and based on the wide range of student ages. A total of 50 hours of participant observation were conducted at Janesville.

At Gilsonville, a community organization ran the school garden. Once a month, a nutrition educator from the community organization and several volunteers led a one-hour long GBNE and cooking session in each classroom. At Gilsonville, garden-based nutrition time was not considered release time for classroom teachers. Therefore, classroom teachers at Gilsonville

were included in participant observations. Concepts from the garden were integrated into each of the lessons; however during the three months of participant observation, early September through early December, students at Gilsonville did not spend time in the garden during the classroom-based lessons. Students at Gilsonville reportedly spent much more classroom time in the garden during the spring and early summer months, although the researcher did not witness this garden time, as participant observation was only conducted during the fall. Students did, however, engage directly with the garden through an after-school garden club that was offered throughout the school year. A dedicated volunteer led the after-school garden club once a week for 90 minutes. Between 5 and 10 students attended the garden club on a regular basis. These students had the opportunity to participate in physical activity, arts and crafts, cooking and hands-on gardening activities. A total of 85 hours of participant observation were conducted at Gilsonville.

Preceding participant observation at both schools, the researcher was introduced to the students by a trusted teacher. The purpose of the project was read out loud to kindergarten through second-grade students and a document describing the project, in addition to a verbal description was provided to third through fifth-grade students. Verbal assent was obtained from kindergarten through second-grade students and written assent was obtained from third through fifth-grade students. Identifying information was not collected and the students did not engage in any researcher-implemented gardening activities. Parental consent was obtained for Janesville students. At Gilsonville, the researcher encountered difficulty in obtaining returned parental consent forms. Previous organizations working with this school had experienced similar challenges to obtaining returned signature forms. For this reason, the Michigan State University Institutional Review Board provided a waiver of parental consent under the conditions that

personal identifiers were not obtained from any student and that the researcher obtained student assent. Nutrition educators and classroom teachers who engaged in participant observation sessions provided written informed consent. The researcher spent over 50 hours at each site. Participant observation included engaging in classroom and garden activities with students, assisting teachers with lessons and recording field notes after observation sessions.

In addition to interviews and participant observation, the researcher engaged in informal conversations with school staff outside of the classroom. Informal conversations led to trust building between the researchers and the study participants.

3.2.5 Student Work

Student work, in the form of written activities not planned or implemented by the researcher, was collected at both schools after several garden-based nutrition lessons. Three writing assignments, totaling 90 individual examples, were collected and analyzed by the researcher. Two of these assignments were completed at Gilsonville by first-grade ELL students. These were simple writing activities that included students creating sentences from words that they had used during the garden-based lesson. The writing activity collected at Janesville was completed by fifth-grade students. These students had the opportunity to write about their "dream gardens" or to describe how they had used their five senses in the garden. Student assent and parent consent were obtained before collection of student work.

3.2.6 Data Analysis

Data were analyzed holistically, in that data from both schools were pooled as one unit of analysis (Yin, 2003). Following interview transcription and proofreading, a codebook was

developed. An iterative process of codebook development and data analysis, based in grounded-theory, began with open coding (Corbin & Strauss, 1990). Five transcripts from both schools were preliminarily coded in a process through which open codes were developed. ATLAS.ti 5.7.1 qualitative analysis software was used for coding (ATLAS.ti, 2011). Open codes were then condensed and categorized into concise groups, which constituted the final codes. These codes were assigned specific definitions and parameters. The five transcripts were re-coded, along with the remaining seventeen transcripts, field notes from participant observation, and student work, using the completed codebook. As coding progressed, several of the code definitions were adjusted to better reflect emerging themes. Open coding and adjustment of the codebook followed a naturalistic process as described by Lincoln and Guba (1985) (Lincoln & Guba, 1985). Descriptive characteristics (Table 3) for both schools were obtained from school principals and US Census data (United States Census Bureau, 2011). Teachers, administrators, school staff and students identified numerous factors associated with the school garden experience. Two overarching themes emerged: (1) outcomes associated with school gardens, and (2) facilitators and barriers to school gardening. This paper discusses features identified within the first theme – outcomes associated with school gardens. Facilitators and barriers to school gardening are discussed in Chapter Four (Martin, 2011).

Table 3. Descriptive Information: District, School, and Garden Program

	Gilsonville Elementary	Janesville Elementary
District *		
School District Population	122,593	5,651
School District Race/Ethnicity	66.7% White 24.0% Black or African American 0.8% American Indian or Alaska Native 3.9% Asian 13.0% Hispanic or Latino (of any race)	98.4% White 0.5% Black or African American 0.6% American Indian or Alaska Native 0.09% Asian 1.5% Hispanic or Latino (of any race)
School **		
Number of Students	354	514
% Students SNAP Eligible	97.2%	64.5%
% Students ELL	60.2%	0%
% Students Special Education	4.5%	6.8%
Garden Program		
Physical Layout	Outdoor Garden and hoophouse	Outdoor garden, farm program with livestock on pasture, and greenhouse
Frequency of Garden Activities	Monthly in homeroom (all students), Weekly after school (5-10 students)	Weekly in nutrition classroom
Adult Semi-Structured Interview Participants	4 Classroom Teachers, 1 Literacy Special Teacher, 2 Nutrition Educators, 2 Food Service Staff, 2 Custodial Staff, 1 Principal	4 Classroom Teachers, 1 Literacy Special Teacher, 2 Nutrition Educators, 1 Food Service Staff, 1 Librarian, 1 Principal
Adult Observation Participants	15	1
Student Observation Participants	260	114
Number of Expamples of Student Work Collected	21	69

* Data from US Census American Fact Finder (United States Census Bureau, 2011)
** Data provided by the school principal

Table 4. Questions from School Administrator Interview Guide

Question Category	Overall knowledge of and experience with the garden
Broad Question	I'd like to talk with you about your school's garden. Can you tell me about the garden?
Probe Questions	1. What do you think about you school's garden? 2. How long has your school had a garden? 3. How was the decision made to start the garden 4. How is the garden used at your school 5. Do you think that using the garden is effective in teaching curricular subjects such as math or language arts? Why or why not? 6. Is the garden used for nutrition education? Do you think that the garden is an effective tool for teaching nutrition? Why or why not? 7. Do you think that using the garden as a teaching tool has advantages over other methods of student engagement? Describe the advantage(s) you have experienced. Is this (advantage) a reason that you support the garden? 8. Does using the garden have limitations compared to other methods of student engagement? What have you experienced as limitations of using the garden? 9. Overall, do you support the garden at your school? If so, why? If not, why not? How do you communicate your support or lack of support?

3.2.7 Theoretical Framework

Students' improved fruit and vegetable intake has previously been recognized as an outcome associated with GBNE and was also an outcome found in this study (Herman et al., 2006; McAleese & Rankin, 2007; Heim et al., 2009; Parmer et al., 2009; Ratcliffe et al., 2011). Following identification of seven outcomes associated with GBNE at Janesville and Gilsonville, a grounded-theory conceptual framework explaining the route through which GBNE improves fruit and vegetable intake was developed.

In order to understand how garden-based learning improves fruit and vegetable consumption, first, a review of the theoretical determinants of fruit and vegetable intake among children was conducted. Researchers have utilized several theoretical frameworks, including the

Social Cognitive Theory (SCT), the Social Ecological Model (SEM) and the Knowledge-Attitude-Behavior (KAB) model to explain students' eating behaviors (Story et al., 2002; Contento, 2007). With regard to fruits and vegetables, several constructs from these three models have been explicitly associated with intake among children (Story et al., 2002; Contento, 2007; Birch & Fisher, 1998; Kristjansdottir et al., 2006; Reynolds et al., 1999; Brug et al., 2008; Resnicow et al., 1997; Domel et al., 1993; Domel et al., 1996; Cullen et al., 2003). Figure 4 depicts intrapersonal, interpersonal and physical environmental factors that have been identified as determinants of children's fruit and vegetable intake.

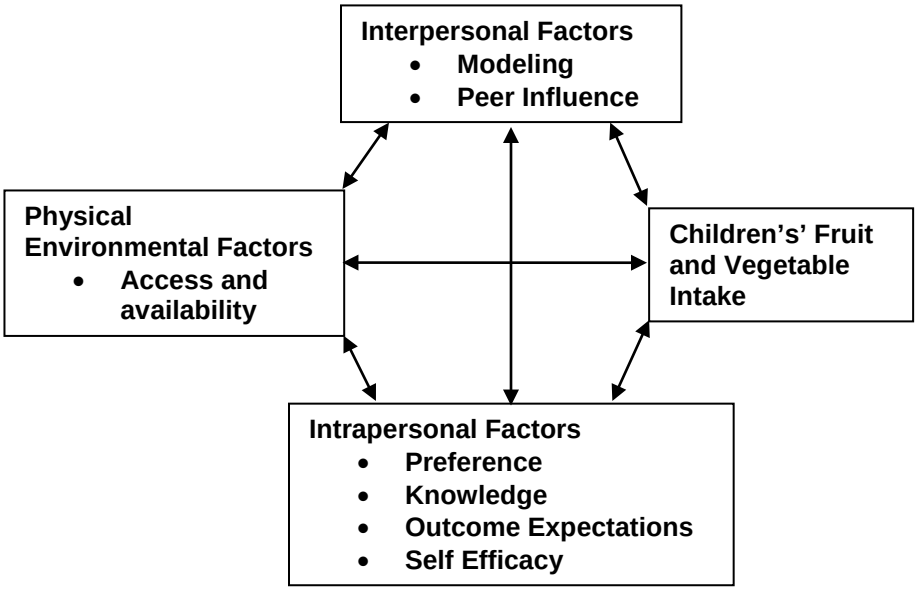

Figure 4: Determinants of children's' fruit and vegetable intake from SCT, SEM and KAB.

In addition to promoting increased intake of fruits and vegetables, the gardens at Janesville and Gilsonville were found to provide an opportunity for hands-on, experiential education. Following emergence of the hands-on nature of garden-based learning as a theme, a

fourth theoretical framework, based on theories of experiential learning, was recognized as relevant to the relationship between GBNE and students' fruit and vegetable intake. Factors associated with experiential learning have not previously been used to explain the effect of GBNE on nutrition outcomes. Theoretical implications of the hands-on learning experience associated with GBNE may be a missing link in the current understanding of how gardens improve students' fruit and vegetable intake.

Experiential education leads to increased knowledge and skill development through a process by which students engage in direct experiences, and enhances learning because learners contextualize the materials at hand (AEE, 2011; Kolb, 1985). By providing an environment through which students engage in experiential education, educators enhance the physical and social context for learning (Carver, 1996). In her essay describing the theoretical framework for experiential education, Carver (1996) explained that this type of education develops personal agency, a sense of belonging and competence (Carver, 1996). Personal agency, as described by Carver, is similar to the Social Cognitive Theory's concept of self-efficacy, described in a nutritional context by Contento (Contento, 2007). Competence is similar to the Social Cognitive Theory's concept of behavioral factors, including knowledge (Contento, 2007).

Following data collection and analysis, two models were developed. The first model (Figure 5), which is purely data driven, depicts outcomes associated with GBNE at the two schools. The second model, based on data and theory, provides a hypothesis for the routes through which GBNE leads to increased fruit and vegetable intake among students.

3.3 Results - Perceived Outcomes of School Garden-Based Nutrition Education

The garden programs at both schools focused primarily on nutrition education and received a majority of their funding through USDA SNAP-Ed grants (USDA, 2010). Differences between district-level, school-level and garden-level characteristics existed between the schools (See Table 3).

Seven positive outcomes, describing the roles that the gardens played at Janesville and Gilsonville and describing student and staff experiences associated with school GBNE, were identified. These outcomes were: (1) enhanced school learning experience, (2) enhanced nutrition knowledge, attitudes and behaviors, (3) improved understanding of food systems, (4) character development, (5) enhanced life experience, (6) intergenerational relationships and community engagement, and (7) feelings of enjoyment, wonder and therapeutic effects among students and staff. Outcomes were communicated in two distinct ways: potential positive outcomes and witnessed positive outcomes. Table 5 provides a detailed description of these outcomes. An example of a potential outcome would be a participant indicating that the garden *could* impact nutrition knowledge, whereas an example of a witnessed outcome would be a participant indicating that they had actually *seen* an improvement in nutrition knowledge.

Table 5. Perceived Positive Outcomes Associated with School Garden-Based Nutrition Education

Positive Outcomes	**Specific Outcomes** (# of Interview Participants to Describe Each Outcome, **# of Field Notes to Describe Each Outcome**, *# of Examples of Student Work to Describe Each Outcome*)
Enhanced School Learning Experience *	1. Described Potential for Curricular Integration (11) a. Science (7) + b. Language Arts (7) + c. Mathematics (4) + d. Social Studies (4) + 2. Described Actual Curricular Integration (14, **4**, *90*) a. Science (7, **1**) ++ b. Language Arts (5, **3**, *90*) ++ c. Mathematics (4, **1**) ++ d. Social Studies (3, **1**) ++ 3. Hands-on Learning Environment (16, **12**, *13*) ++ 4. Spontaneous and Cross-curricular Learning (4, **2**) ++
Enhanced Nutrition Knowledge, Attitudes and Behaviors *	1. Nutrition Knowledge (7, **2**, *2*) a. What is healthy food (3) + ++ b. Vegetables promote health (1, **1**, *2*) ++ c. Vegetable and some fruit identification (3) + ++ 2. Nutrition Attitudes (14, **9**, *8*) d. Willingness to try new foods, including vegetables (12, **6**, *7*) + ++ i. Willing to try vegetables grown by students (4, **3**) + ++ e. Increased preference for vegetables (8, **6**, *1*) + ++ 3. Nutrition Behaviors (14, **13**, *8*) f. Eat new foods, especially vegetables, during garden-based lessons (7, **12**, *8*) ++ g. Select more vegetables from school lunch (4) + ++ h. Data collection, by nutrition educators, showed improved fruit and vegetable intake (1) ++ i. Select healthy food, especially vegetables, outside of school setting (6, **5**) + ++ i. Improved home asking behavior for healthy foods, especially vegetables (4, **1**) + ++ 4. Behavior change likely to last into adulthood (1) +

*Student outcome **Student and adult outcome +Includes potential outcome ++ Includes witnessed outcome

Table 5 (cont'd). Perceived Positive Outcomes Associated with School Garden-Based Nutrition Education

Positive Outcomes	**Specific Outcomes** (# of Interview Participants to Describe Each Outcome, **# of Field Notes to Describe Each Outcome**, *# of Examples of Student Work to Describe Each Outcome*)
Improved Understanding of Food Systems *	1. Improved Understanding of Food System (14, **3**, *8*) a. Example of organic food production (3) ++ b. Learn where food comes from (10, **2**) + ++ c. Learn how to grow food (7, **2**, *8*) + ++ d. Appreciation for labor and financial cost of food production (5) + ++ e. Introduce farming as a career (3) +
Facilitate Character Development *	1. Responsibility, Respect and Patience (4) + ++ 2. Pride, Accomplishment and Ownership (5, **2**) + ++ 3. Developed sense of community and enjoyment in sharing food with others (3) + ++ 4. Long-term goal setting (1) + 5. Outlet for self expression (1) ++
Provide Life Experiences *	1. Enriching life experiences, specifically experiences with nature and natural processes (10, **1**) + ++
Fostered Intergenerational Relationships and Community Engagement *	1. Meaningful relationships between children and non-familial, non-teacher adult (1, **1**, *21*) ++ 2. Engaged community volunteers (4, **4**) ++
Nurtured Feelings of Enjoyment, Wonder and Therapeutic Effects among Students and Staff **	1. Therapeutic experience (6, **1**) ++ 2. Feelings of Enjoyment and Wonder (16, **7**, *8*) ++

*Student outcome **Student and adult outcome +Includes potential outcome ++ Includes witnessed outcome

3.3.1 Enhanced School Learning Experience

Over half of the interview participants discussed potential and witnessed enhancement of the students' school learning experience associated with GBNE. These participants believed that the gardens enhanced learning in several ways: (1) gardens held potential for and were actually incorporated into core curricular instruction, (2) gardens provided a hands-on learning environment, and (3) gardens fostered spontaneous and cross-curricular learning. These findings were confirmed upon analysis of student work and field notes.

Potential and Actual Integration of Garden-Based Learning into Core Curricular Instruction

The primary purpose of the gardens at both schools was nutrition education. However, due to the presence of the gardens, classroom teachers and nutrition educators incorporated garden-based lessons into curricular teaching. Interview participants at both schools described potential integration of garden-based lessons into four main curricular subjects: Language Arts, Science, Mathematics and Social Studies. For example, a classroom teacher from Gilsonville explained that the garden could be used as a tool for science teaching:

> *Teaching them about growing - like what plants need to grow, how they grow, the parts of a plant. So it would be a really good curricular activity - to do that and then to watch. It would be a great science activity …. there's so many different things you can do with growing plants.*

Half of the interview participants described actual integration of garden-based learning into academic instruction. For example, a classroom teacher at Janesville explained that the

nutrition educator worked with teachers to integrate garden-based nutrition lessons with current curricular topics:

> *Researcher: Do you think if there were time, would the garden be able to be used for curricular subject teaching?*
>
> *Teacher: Oh sure. Yes, yes. Yeah, definitely. And* [the nutrition educator] *does a good job of that too. She knows we're studying a certain thing that she can help with in our curriculum … when we studied Native Americans, she said 'Would you like me to do something with corn and nutrition?'*

At Gilsonville, teachers placed special emphasis on the gardens ability to enhance literacy learning. With over 50% of Gilsonville's students learning English as a second language, teachers at the school used the garden to teach vocabulary and to improve writing skills. For example, a participant at Gilsonville explained:

> *We teach them how to run safely, you know. Teach them how to not walk 'on' the bed, but to walk 'around' the bed. See how much vocabulary that is . . . Remember, these are not English speakers. So to just explain 'on' and 'around', that's new vocabulary words to them.*

Field notes and student work described and exemplified the integration of garden-based lessons into curricular teaching. For example, students at both schools engaged in writing exercise based on gardening activities. In the following example of student work, garden-based experiences are connected with science concepts (identifying and describing the senses) via a language arts writing activity:

> *In the garden I use my 5 senses by listening to the leaves swaying in the wind. I can see the tomato worm crawling on the tomato plants of course I pick it of and throw it. I smell*

the basil everywhere I go. Good thing I like the smell of it. I touch the sage it feels rough. But I bring the sage to my mouth and I brush my teeth with it. But most of all I love tasting everything in the garden. I like tasting tomatoes, cucumber, strawberries, lettuce, spinach, and berries. Now you know how I use my senses.

Hands-on Learning Experience

The gardens at Janesville and Gilsonville were environments for hands on learning, both for nutrition concepts and for core curricular concepts. Overall, sixteen of the twenty-two interview participants linked the gardens with hands-on learning. In fact, hands-on learning was the most frequently reported outcome. Field notes and student work also offered testimony to the hands-on nature of garden-based learning.

The hands-on learning experience provided by the gardens was described as a unique benefit compared to traditional classroom-based learning. A participant at Gilsonville explained that the hands-on nature of garden-based learning enhanced students' desire to learn:

Once you give them the opportunity to dig, or to cover seeds, or water something, they're all about it because they want to learn. They want to be able to get these new experiences in as quickly and as much as possible . . . . Because they do have this natural wonder about the world around them. And what happens when you go to school is you get kind of shoved in little boxes and get really rigid about what you should do, shouldn't do. And it really kind of dries out the kids' imaginations and it dries out their ability to want to learn. And so bringing that garden back into it helps them to . . . . get that wonder back.

The principal at Janesville explained that hands-on learning was a desirable method of student engagement, especially for students who learned best through a kinesthetic or tactile

approach: *"Anytime that you can use hands on, a hands on approach, it helps that tactile learner."*

Referring to the hands-on nature of garden-based learning, an educator at Janesville explained that the garden engaged students for whom traditional classroom-based learning may have been a challenge:

> *It is hands on. It's something different. They're learning in a different environment. They're experiencing it . . . . You remember by doing. And so I think it has that definite advantage . . . . Kids who maybe aren't proficient readers, aren't as proficient writers, maybe not be as good at paper pencil kind of tasks, can fully participate and have the entire experience . . . . A lot of kids who aren't proficient in the classroom kind of things compensate by being strong in those other areas.*

Spontaneous and Cross-curricular Learning Experience

The gardens also provided rich opportunities for spontaneous learning and cross-curricular engagement. When comparing classroom-based learning to garden-based learning, a participant at Janesville explained this concept:

> *The garden is a place, also, that is good for spontaneous learning. Like, we went out to do X, but while we were there, we noticed things and we learned about Y. So, it's a place where that can happen …. It inspires wonder and curiosity in kids, as opposed to doing something in the classroom .… It's also a really good place for cross-curricular learning. So you could go out into the garden and do an activity and you've learned math and science and social studies and you write about it …. So you've really learned, you've gone across the curriculum. So I think it has advantages in that way as well.*

In an example of the garden's ability to facilitate spontaneous and cross-curricular learning, a classroom teacher at Gilsonville described a situation in which she made an "on the fly" decision to incorporate the garden into a science lesson. She explained:

> *It was a last minute impromptu decision. We were working on, in science, we were working on senses. And so I thought that was a really good way to talk about visual sense and what did you observe with your eyes …. And then we came back and wrote a little bit about what we had seen, and things like that."* What began as a science lesson, ended up reaching across the curriculum.

3.3.2 Enhanced Nutrition Knowledge, Attitudes and Behaviors - Vegetables and Some Fruits

Descriptions of potential and actual nutrition outcomes emerged from the data. Participants believed that GBNE improved students' nutrition knowledge, attitudes and behaviors regarding new foods, especially for vegetables and some fruits. Field notes from participant observation and student work also suggested that GBNE improved fruit and especially vegetable knowledge, attitudes and behaviors.

Nutrition Knowledge

Interview participants described potential improvements or stated that they had actually witnessed improvements in students' nutrition knowledge as a result of GBNE. Three subcategories of possible or witnessed improvements in nutrition knowledge were identified: (1) GBNE led to an understanding of what constitutes a healthy food, (2) GBNE taught students that vegetables promote health, and (3) GBNE led to students' increased ability to know the names of and identify vegetables and some fruits.

GBNE was described by interview participants as a means through which children could possibly and had actually learned to differentiate between healthy and unhealthy foods. For example, a participant at Gilsonville explained this concept: *"They* [are] *learning to eat healthy from that* [the garden]. *'Cause it's available each time they come here … when they have the program* [after-school garden club] … *Also they learn what is good, what is not, for them to eat."*

One participant identified the school garden as a means through which children learned about the health benefits of vegetables. In response to a question regarding whether or not GBNE was effective at teaching students nutritional concepts, the participant stated:

> *Oh definitely! I think it really does. Because the kids realize that what grows in the garden is good for their bodies …. that fruits and vegetables are important for the body.*

One field note and several examples of student work also showed that GBNE was associated with students learning that vegetables promoted health. In an example from the student work, a student from Janesville explained their reasoning behind selecting wheat, berries, carrots and apples to plant in their "dream garden": *"I would put all of those healthy foods in my garden because I need three healthy foods each day. I would have a big round garden with colorful rocks around it. With healthy foods I will have enough energy every day to take care of my garden."*

Participants also explained that GBNE could possibly and had actually improved students' ability to know the names of and identify vegetables and some fruits. For example, an educator at Janesville described students' improvement in identifying vegetables:

> *And so I get a kick out of it, because I have books, you know, the beginning letters, and it has 'peas' and 'potato' in the 'P'* [section]. *And I had kids miss every time the 'peas' and most of them missed the 'potato'. And now these last two years since we've had the*

[GBNE], *they don't skip a beat. "Peas, potato, beans' . . . I mean, they know what they're called, when they didn't know before. I noticed a big difference.*

Descriptions of potential or witnessed improvements in nutrition knowledge were less common than descriptions of potential or witnessed improvements in nutrition attitudes or nutrition behaviors. When asked to describe outcomes of garden-based learning, participants often jumped directly into describing visible changes in attitudes and behaviors rather than describing more subtle changes in nutrition knowledge.

Nutrition Attitudes

The most commonly-described nutrition outcomes associated with GBNE were: (1) students' increased willingness to try new foods, including vegetables and unfamiliar fruits, and (2) students' increased preference for vegetables. These two outcomes were also revealed upon analysis of field notes and student work.

Over half of the interview participants described either potential or witnessed improvement in students' willingness to try new foods, including vegetables and unfamiliar fruits, as a result of garden-based learning. For example, an educator from Janesville described improvements in students' willingness to try vegetables, and specifically vegetables that the students had grown.

Kids are more willing to try food, basically, when they've grown it, you know? I mean, we have kids who eat radishes who probably would never eat a radish that's all cut up and put in front of them. But they'll try it in the garden or they'll try peas in the garden or they'll try broccoli.

In an example of student work, a student from Janesville explained: *"I like tasting new things, like when we are in the garden I love tasting* [stuff] *like tomato, broccoli, carrots and other* [stuff] *too."*

Half of the interview participants described either potential or witnessed improvements in students' preference for vegetables as a result of GBNE. For example, an educator from Gilsonville described a shift in students' preference for spinach from the garden:

> *We were going to make spinach dip. The kids' first attitude is like 'Eww, spinach! I don't want that!' But then we had to go out to the hoophouse to harvest the spinach. And so just the transition from me telling them spinach, 'Gross, yucky', to walking to the hoophouse, they started running. And they were screaming 'Spinach!' with their arms in the air, 'Spinach!', all the way to the hoophouse . . . And then as soon as we brought it back in and we washed it off . . . they made a spinach dip. They couldn't have enough of it. They were asking for seconds and thirds.*

Nutrition Behaviors

Interview participants described either potential or witnessed improvements in nutrition behavior associated with GBNE.

Seven participants indicated that students ate new foods, especially vegetables, during garden-based nutrition lessons. In a field note, the researcher described witnessing a student eat a fresh vegetable in the garden: *"He came up to me with a beautiful pepper plant with a huge green bell pepper hanging from its' branches. Before I could even say "Wow!', he took a bite out of the side of the pepper …. He ate it like an apple."*

Four participants described potential or witnessed improvements in students' selection of vegetables from the school lunch as a result of GBNE. One participant, a nutrition educator at Gilsonville, explained that extensive data had been collected by the community organization that ran the garden. According to the nutrition educator, the data showed that GBNE led to increased fruit and vegetable intake among students. Six participants described potential or witnessed (via parental report) improvements in students' selecting healthy foods, especially vegetables, outside of the school setting. Most of the participants who described improved eating habits away from school emphasized either potential or witnessed (via parental report) improvements in students' home asking behavior for healthy foods, especially vegetables. And finally, one participant indicated that GBNE would likely impact students' eating behaviors from childhood into adulthood.

3.3.3 Improved Understanding of Food System

Interview participants, field notes and examples of student work described either potential or witnessed improvements in students' understanding of the food system as a result of GBNE.

Several interview participants indicated that the school garden provided an example of organic food production to students. A staff member from Gilsonville, explained: "*They actually get to see the process, how there's no chemicals really used. And so they're getting pure stuff.*"

GBNE was also described as a means through which students learned about the origins of food. For example, a classroom teacher explained that the garden at Gilsonville helped students learn that food originated, not from the grocery store, but that food had to be grown or raised:

I think it just makes them aware of where food comes from. Kids don't really leave their homes very much in this area. They might go to [the grocery store] *or something like that, but they don't go to farms . . . they don't really get out very much . . . When you ask a kindergartener, 'Where does milk come from?' they'll say* [the grocery store] . . . *But for them to see, 'That's where the lettuce came from, that's where the tomatoes came from'. That's a direct connection for them.*

Similarly, GBNE helped students understand how food was grown. This outcome was described by interview participants, in field notes and exemplified in student work. For example, a classroom teacher from Janesville explained: "*It* [the garden] *also helps at the elementary level, for the kids who don't live on farms to see how things work, how plants grow. I think it helps them understand the foods they eat.*" In an example of student work, a student from Janesville demonstrated their understanding of basic gardening techniques:

I would make the garden where this little bit of sun that cover the whole garden. I would do that because some plants cannot grow without sun. I would plant the seed where there is not a lot of weeds so the weeds will not take over the garden. I would plant the seeds in rows because if I don't plant in rows I won't really know where I put the different seeds.

Participants also believed that GBNE instilled in students an appreciation for financial cost and labor requirements associated with food production, especially in the midst of economic uncertainty and hardship. For example, a classroom teacher at Janesville explained:

I just think it's important for them to see where their food comes from and have a better understanding that their parents pay money for it, so they don't waste it . . . . You know, they don't have it, and they, I'm broken hearted when I see them throw food away because I know their parents struggle to pay for things.

A classroom teacher from Gilsonville expressed a similar sentiment: "*I think that it's important for students to, first of all, appreciate land, our earth, and the fact that farmers, they spend a lot of time growing food.*"

And finally, several participants from Janesville, a school situated in the heart of a rural farming community, explained that the school's garden might introduce farming, as a career, to students. For example, an educator at Janesville explained: "*They* [the students] *can see that it* [growing food] *can be a livelihood. And you know, you can work at it, it can be a hobby or it can be a livelihood.*"

3.3.4 Character Development

GBNE was described in interviews and field notes as having positive effects on factors associated with character development among students. These effects on character development were described as potential and as actually witnessed. Interview participants and field notes indicated that GBNE: (1) possibly or actually taught lessons in responsibility, respect and patience, (2) possibly or actually gave students a sense of pride, accomplishment and ownership, (3) possibly or actually promoted a sense of community and enjoyment in sharing food with others, (4) could provide students with experience in long-term goal setting and (5) offered students an outlet for self expression.

Interview participants explained that GBNE could potentially and had actually fostered the development of responsibility, respect and patience among students. An educator at Janesville explained that the patience required to tend a garden could be used as an analogy to describe the patience required for students to "tend" their own academic growth:

> *If you're going to learn how to read, you've got to take time to read. You have to work at it. It takes time, it takes care . . . . You can't just expect to read . . . . And with the garden, it takes time. And it takes a lot of work. And it just doesn't happen. We're kind of like a 'Now' society, you know, you go buy it now, you got it, but you know, it's kind of a life lesson.*

In another example, an educator at Gilsonville described the gardens' ability to nurture a sense of patience among students. She explained that the garden at Gilsonville provided curricular learning opportunities but that life lessons were also included: *"And it takes time, so the kids learn how to wait patiently. And you have to give water and you have to set them* [the plants] *near the sun - the windows - so they get sunshine …. So that science, that's part of everyday life too."*

Several interview participants explained that gardens could possibly and had actually fostered feelings of pride, accomplishment and ownership among students. For example, a classroom teacher from Janesville explained:

> *It kind of gives them the sense of ownership, I mean, it's stuff that they've been involved with for years, that's like a part of them. That's what they're doing and they know how to do it. It gives them confidence in different things …. It gives them something to do that's theirs. That's what I think. And that's important for a kid.*

In a field note, the researcher described a conversation with a student in which the student indicated that she had kept track of radishes that she had planted earlier in the season. This student exemplified a sense of pride or ownership for her work in the garden:

One of the girls was telling me that she thinks the radishes we'll be trying are the radishes they planted earlier. I asked if she knows which bed they planted and she told me she's gone and checked on the plants a few times since they planted them.

Interview participants at Gilsonville described that the garden fostered a sense of community and enjoyment in sharing food with others. For example, an educator described an experience through which the garden facilitated students' sharing fresh produce with community elders at a local high-rise apartment building. Although the students had also earned a small amount of cash for their time and effort selling garden produce at a nearby farm stand, the nutrition educator explained that students were most excited about the experience of sharing food with community members.

Additionally, one participant, a classroom teacher from Gilsonville explained that the school garden had the potential to help students develop skills in goal setting. This teacher had been working with her students to develop an understanding of the concept of time, for example, distinguishing between "today" and "tomorrow." She explained that the garden at Gilsonville could help expand students understanding of the time span associated with long-term goal setting.

I think that it [gardening] *can provide them a long-term goal. In kindergarten we do a lot of little short pieces, little short goals. But I think that that could provide them an example of a long-term goal. Where, you know, first it gets planted, and you know, going through all those steps. Um, because we don't, in kindergarten, we don't really have a lot of long-term goals that you could actually see something happening. And, while it might be continued from kindergarten to first-grade for example, if they plant stuff in the spring, and then they are able to see it when they come back in the fall, that would show*

them, very distinctly, the culmination of a goal. And that's a big thing that we work toward in kindergarten. You know, we have one-step directions, two-step directions, three-step directions. But we're also working on steps for our goals.

Finally, one participant, a staff member at Janesville, explained that the school garden provided an outlet for self expression. She explained:

I think it's an opportunity for kids to have a sense of worth and accomplishment …. It's hard to describe, but I really think there's definitely benefits to it, you know in expressing themselves through the language arts when they're writing, um, and it's just one more experience."

In the above example, the lines separating the various categories of benefits associated with school GBNE began to blur. The multiple benefits that participants described were often interconnected. For example, in the previous example from Janesville, the participant explained that students could express themselves through writing about their garden experience. In this case, curricular integration and self expression, both perceived benefits associated with the school garden, were interconnected.

3.3.5 Life Experience

The concept of students' life experience emerged during conversations about GBNE. Interview participants at both schools explained that many of the students led lives devoid of experiences. Teachers at Gilsonville expressed concern that children rarely left the urban jungle of concrete and traffic. Teachers at Janesville admitted that even though the landscape appeared pastoral, many of the children did not have the opportunity to explore the natural world around

them. Participants indicated that the gardens were beneficial simply because they broadened the life experiences, and especially experiences with nature, of these children.

A classroom teacher from Gilsonville explained that experiences made possible through the garden program were beneficial to students, particularly to the students at a low-income, urban school.

> *I think it's really good here because we're an urban school. And we've taken field trips …. where they've seen the big gardens and, and I think it's really good 'cause a lot of kids, they never get out of this neighborhood, most of them, and it's sad. But I really, I think that's why it's helped the school the most, is because we are such an urban, poor school. But to have something like this is just great. I love it. And I know there's some teachers that don't even sign up for it* [the garden program]. *And I just think that's sad. 'Cause I think all the kids should be experiencing it.*

She later went on to share: *"It's all about experience. These kids need the experience. 'Cause they don't get it any other way."*

A second participant from Gilsonville explained that the school garden provided a unique experience, especially for students who had recently immigrated with their families to the United States. She explained that many of these students lived in apartment buildings and did not have access to the natural world.

> *I personally like this garden club because it offers the kids the chance to go outside to the hoophouse, to the garden, where they can actually see what an asparagus plant looks like. What broccoli looks like, what corn looks like. With a lot of the Asian and African kids, their roots were in agriculture. And I like to give them the opportunity to dig with their hands, feel the dirt, 'cause right now they're all living in apartments, all concrete.*

Students' reported lack of experience at urban Gilsonville was mirrored at rural Janesville. A staff member at Janesville explained that the children at the school lacked life experiences. She indicated that the GBNE program provided extra experiences to the students: *"It's just one more experience. And we have kids that have often so few experiences. Any additional experiences we can give them helps in their education."* In another example, a classroom teacher from Janesville compared the school garden experience to a field trip. She explained: *"It's like a field trip every time they go out there. It's like a huge high excitement thing. And they never go out there without learning something. There's just a wealth of knowledge."* The researcher expressed similar sentiments in a field note recorded after a participant observation session in late November at Janesville. On that particular day, the students learned about the meat and beans food group. As part of the lesson, the nutrition educator took the students out to the pasture (maintained by the district's high school Agriscience program) to observe, firsthand, a flock of turkeys being raised for sale during the upcoming holiday season. After participating in the pasture walk, the researcher marveled at the unique experience made available to the students through the schools GBNE program:

> *They* [the students] *go on field trips every week - out to the garden, to the greenhouse, to the pasture. They enjoy it - it is a time to relax and enjoy learning. To these kids, this is normal. But compared to so many other schools, this is an incredibly unique program.*

3.3.6 Intergenerational Relationships and Community Engagement

At Gilsonville, the GBNE program was a means through which children experienced positive interactions with a caring, non-familial, non-teacher adult and a channel through which community members engaged with the school as a whole.

Intergenerational Relationships

A classroom teacher at Gilsonville described the nature of an intergenerational, non-familial relationship that a dedicated volunteer had formed with the children in her first-grade English Language Learner (ELL) class.

> *Researcher: Can you also tell me a little bit about what* [the volunteer] *does when she comes into your classroom?*
>
> *Teacher: Okay … she'll always give a snack, and you know, but she's doing more cultural activities with my kids. And, like today, Christmas activities. And, she's kind of adopted us. You know, and she does fun activities with us. And we'll also go out to the hoophouse and take a tour and, she does all kinds of things. She sometimes sings, because she was a preschool teacher. I love it. 'Oats, peas, beans and barley grow!' You know what I mean, it's cute, now hearing my kids singing it ….*
>
> *Researcher: Oh really, they sing it? When she's-*
>
> *Teacher: When she's not here. Or they'll try to sing it if they don't know the words … But yeah, so everything, it's amazing how much influence just the littlest things have on these kids.*

In a field note recorded by the researcher, the personal nature of the volunteer's relationship with the first-grade class became apparent.

> *As I was leaving,* [the volunteer] *told me about the class time with* [the first-grade class] *.... She was doing another world map activity with the kids. They all had their pictures put up around the map and lines drawn to their countries. They then went around and described their countries and the food they eat.* [The volunteer] *started choking up as she*

was telling me about it. She said that it was very touching and that she'd have to tell me about it another time.

The students in this first-grade class at Gilsonville felt comfortable enough to share personal stories with the volunteer. The volunteer treated the children, not with the authority of a school teacher, but with the gentleness and nurturing of a family friend or mentor. The children, in return, showered the volunteer with praise, hugs and hand-drawn pictures. The volunteer's primary responsibility at Gilsonville was her role as one of the facilitators of the after-school garden club. In addition, however, to her duties with the GBNE program, she engaged in intergenerational relationship building with students.

Community Engagement

The garden program at Gilsonville also promoted community engagement with the school. Interview participants and field notes described the garden as a means through which to facilitate community engagement with the school.

The GBNE program at Gilsonville was financially supported and physically implemented by a community non-profit organization. Because grant funding for the program at Gilsonville did not allow nutrition educators to spend time actually maintaining the school's garden (garden labor was not considered an allowable nutrition education activity by the grantor), the community organization recruited volunteers to maintain the physical garden at the school. Additionally, the salaries of the two full-time garden-based nutrition educators hired by the community organization were generated through a "match" system. The grant that funded the program provided a financial "match" for the time that volunteers spent participating in allowable nutrition education activities. Therefore, volunteers were the life source of the garden

program at Gilsonville. Community volunteers worked at the school, assisting the nutrition educators in garden-based nutrition lessons, in order to generate match to support the salaries of the two full-time garden-based nutrition educators. Volunteers also worked separately from the match system to physically maintain the garden at Gilsonville. The grant coordinator at Gilsonville explained that the GBNE program enjoyed the support of over thirty community volunteers at any given time. In addition to caring for children, it is possible that what attracted these adult volunteers to work at the school was the presence of the garden. These volunteers could have worked at Gilsonville as after-school tutors or as volunteer classroom assistants; however, they chose to engage with the school through the garden.

3.3.7 Enjoyment, Wonder and Therapeutic Effects

Students and staff shared enjoyable experiences, including a sense of wonder and even therapeutic relaxation in the gardens at Janesville and Gilsonville. Interview participants and one field note described therapeutic effects of the gardens. In addition, over half of the interview participants, field notes and examples of student work provided descriptions of the gardens as a place that fostered enjoyment and a sense of wonder among staff and students.

In an example of the garden's therapeutic effects, a staff member at Gilsonville described the garden as a kind of "sanctuary":

> *"I know that I've used it as a place to relax. I take my breaks out there. And when there's tomatoes, I eat a lot of tomatoes. So it's like a little sanctuary also. And if it's a sanctuary for me as an adult, I can imagine that it's also a sanctuary for the kids."*

Interview participants also explained that the gardens at Janesville and Gilsonville facilitated a therapeutic change of scenery for students. A staff member at Janesville explained:

It's [the garden] *is healing, it's comforting. I think it teaches them* [students] *to unwind, to relax. 'Cause I mean it does that for me. To get into gardening. I think it would do the same for children …. I mean, not just papers, papers, papers. But getting into the dirt, getting into the green.*

Interview participants also described a "wonder factor" and the researcher witnessed a joyful fascination among students in the garden. Students responded with sheer elation, one afternoon at Janesville, when a frog hopped out of the lettuce box into the garden path. Similarly, at Gilsonville, when students discovered a praying mantis in the strawberry patch, shrieks of excitement filled the air. An educator from Gilsonville also described the "wonder factor":

In April they start their seeds, in May they transplant. Sometimes they're planting directly in the ground in June, their last week of school. And then when they come back, if they don't go to summer camp, then they just see that sunflower seed, you know is now eight feet tall and so there's that whole miracle. I think for kids, it's more fantasy. It's just like 'Wow, that's amazing! That little seed is now eight feet tall!'

Additionally, a student's sense of imaginative wonder was recorded in a field note at Janesville: *"As* [the] *class was leaving the greenhouse today, I heard one of the girls say 'I wish I could live here - it's so warm - it's like a jungle in here!'"*

3.3.8 Data Driven Model for the Effects of GBNE on Students

As described in the previous sections, GBNE provided numerous benefits to the students at Janesville and Gilsonville. Results from this study were used to construct a conceptual model, driven by both data and theory, proposing the routes through which GBNE improves students' fruit and vegetable intake. Development of the conceptual model was a two-step process. First, a

purely data driven model depicting the outcomes of GBNE was created (Figure 5). Next, a conceptual model was created by integrating data collected in this study with previously existing theory (Figure 6). In the data driven model (Figure 5), GBNE encircles classroom-based nutrition education to indicate that GBNE was used in combination with a traditional didactic nutrition curriculum. As a result of the garden-based learning component, students gained experiences, specifically contextualized, hands-on learning experiences and life experiences. The experiential or hands-on learning component of GBNE was the most commonly described outcome among interview participants at Janesville and Gilsonville. Participants explained that hands-on, experiential learning was among the most effective teaching methods and that the garden was a place where this type of teaching and learning predominated. Stemming from the contextualization of nutrition concepts that occurred as a result of GBNE, students experienced several outcomes. These were: 1) Enhanced nutrition knowledge, attitudes (fruit and vegetable preference and willingness to try), and behaviors (fruit and vegetable intake); increased understanding of the food system, character development, development of relationships based on the experience with food, and enjoyment and wonder in the garden.

3.3.9 Conceptual Model for the Effects of GBNE on Students' Fruit and Vegetable Intake

Development of a conceptual model explaining the effects of GBNE on students' fruit and vegetable intake consisted of integrating the data driven model with concepts from theories of Experiential Education, the Social Cognitive Theory, the Social Ecological Model and the Knowledge Attitude Behavior model. These theoretical concepts were described in the methods section of this paper. This conceptual model proposes a hypothesis for the route through which GBNE leads to improved fruit and vegetable intake among students (Figure 6).

In the conceptual model, as in the previous data driven model, GBNE encircles classroom-based nutrition education due to the combination of traditional didactic nutrition curriculum with the garden-based learning experience. According to the study participants, the overarching outcome of GBNE was hands-on, experiential learning, which led to nutrition related outcomes among students. Additionally, theories of experiential education indicate that hands-on, experiential learning leads to contextualization of new information, increased personal agency, competence, and sense of belonging. For this reason, an arrow composed of dashes of variable sizes, indicating support from both data and theory, connects the "Contextualized Hands-on Learning and Life Experiences" box with the remainder of the outcomes. Both data and theoretical concepts support the idea that hands-on learning leads to enhanced learning outcomes.

A set of six outcomes originates from hands-on contextualized learning. These outcomes are intermediated outcomes, which ultimately lead to the endpoint, increased fruit and vegetable intake among students. The first listed outcome, "Contextualized Nutrition Knowledge" was linked with improved nutrition attitudes (preference for fruits and vegetables and willingness to try) and also directly with increased fruit and vegetable intake. The arrows making this connection are composed of equal length dashes, indicating that this connection was based on theoretical concepts. The connection was made based on concepts of the KAB and SEM models and the SCT. According to the KAB model, improved nutrition knowledge leads to improved attitudes regarding healthy foods, which in turn leads to behavior change (Contento, 2007). The SEM and the SCT posit that improved knowledge also leads to behavior change (Contento, 2007; Story et al., 2002).

The next listed outcome, “Character Development”, and in particular goal setting, ownership, and sharing food with community, was linked with improved nutrition attitudes and also directly with increased fruit and vegetable intake. This link was made based on several theoretical concepts. According to the Social Cognitive Theory, goal setting skills are required in order to achieve behavior change. For this reason, character development was linked directly with increased fruit and vegetable intake. Additionally, a sense of ownership and appreciation of sharing food with community contributed to the link between Character Development and improved attitudes toward fruits and vegetables. This link was made based on the multiple determinants of food preference among children, described by Birch and Fisher. These determinants include: experience with food during early childhood, exposure to foods, and peer and adult influences (Birch & Fisher, 1997). By experiencing a sense of ownership for the garden and the fruits and vegetables grown in the garden, and by associating these foods with the positive feelings that come with sharing garden produce with others, the students may have developed enhanced preference for and willingness to try fruits and vegetables.

The next two listed outcomes, “Enjoyment and Wonder” and “Relationships Based on Experience with Food”, were linked with improved preference for fruits and vegetables and also increased fruit and vegetable intake. The link with improved preference was made based on Birch and Fisher’s description of the determinants of food preference among children. The link with increased intake was made based on the Social Ecological Model. According to the SEM, individual factors such as food preference, which can be influenced by experiences with food during childhood, and also the social environmental context of food, have the ability to influence intake (Story et al., 2002). In this case, students’ positive experiences in the garden and their

association of the garden and garden produce with positive peer and adult relationships may lead to increased fruit and vegetable intake.

The fifth listed outcome, “Increased Availability and Exposure to F&V in the Garden and during GBNE” was derived from a sub-outcome of “Enhanced Nutrition Behaviors” listed in Table 5: students ate new foods, especially vegetables, during garden-based lessons. The reason for this increase in intake is likely due to the simple fact that these foods were available to the students during GBNE. Had the lesson been composed of a traditional lecture-style activity, vegetables and fruits may not have been available to the students. This outcome was linked with improved attitudes toward fruit and vegetable intake based on the concept that experiences with and exposure to foods during early childhood influences preference (Birch & Fisher, 1997). Additionally, this outcome was linked directly with increased intake based on reports by participants, student work, and observations indicating that students ate fruits and vegetables when they were offered and available during GBNE.

The last outcome, “Understanding of the Food System”, was not linked via data or theory to increased intake of fruits and vegetables. The lack of significance may be due to the fact that at a young age, food related decisions may not depend on social and ethical issues involved with a thorough understanding of the food system.

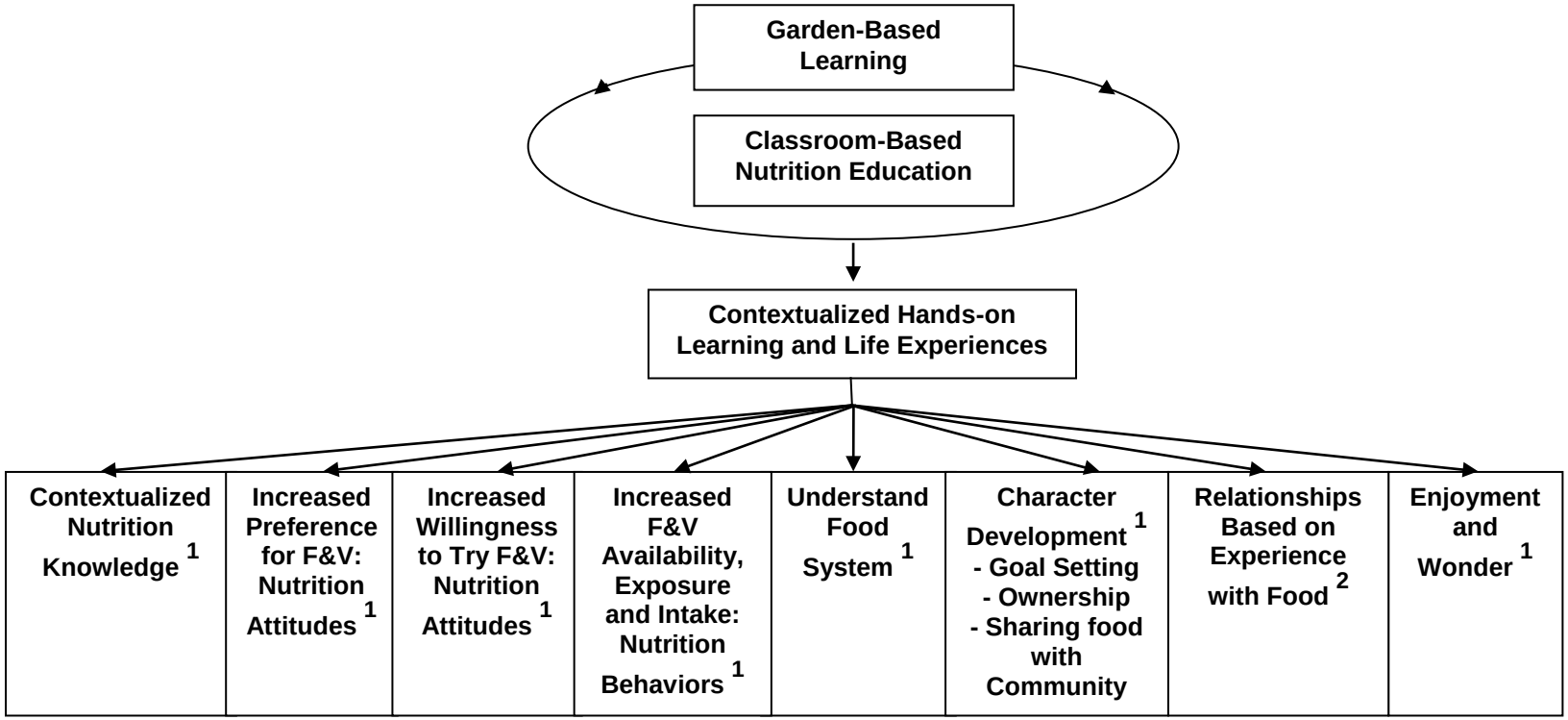

Figure 5: Data driven model for the student outcomes of garden-based nutrition education

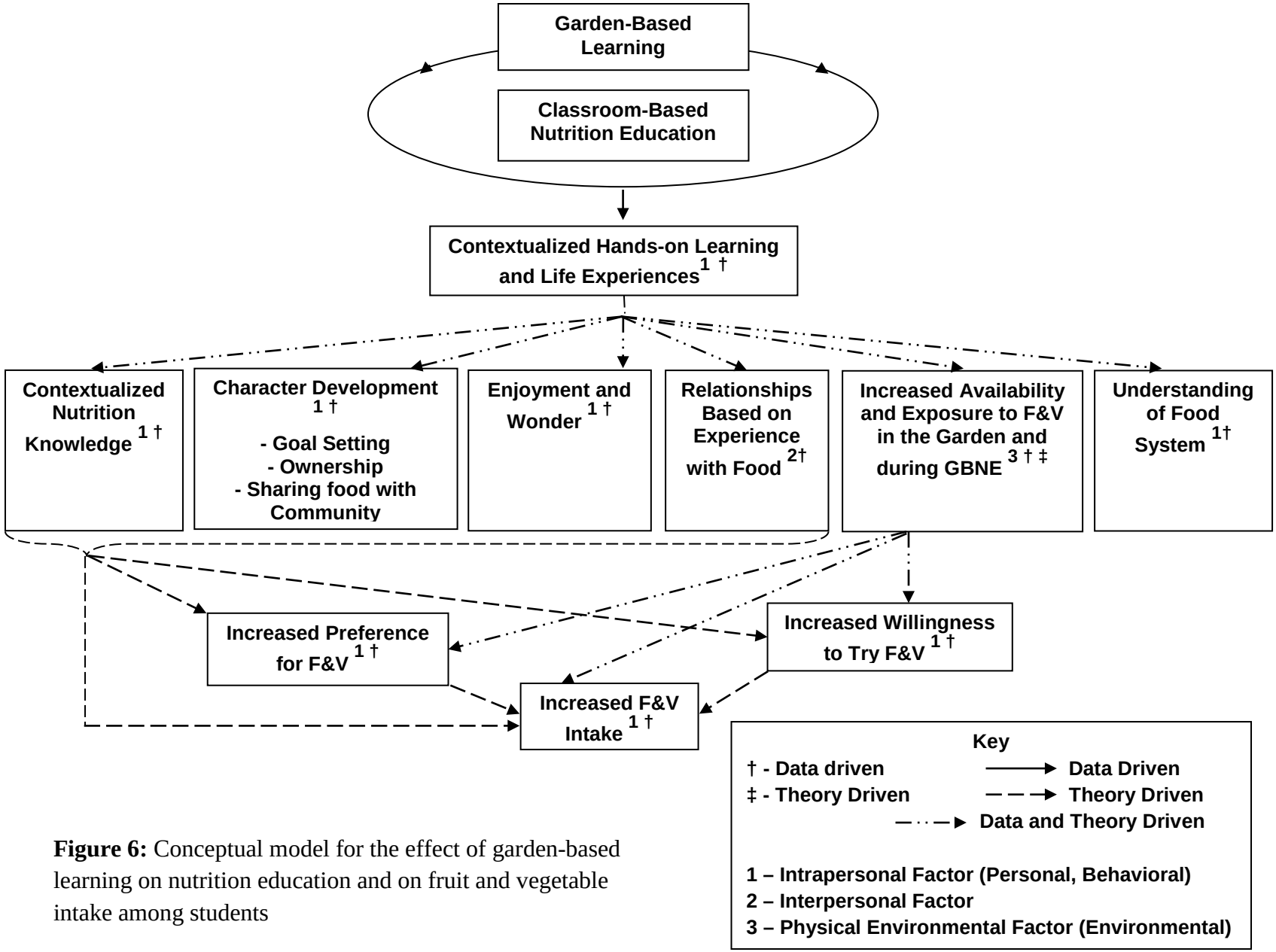

Figure 6: Conceptual model for the effect of garden-based learning on nutrition education and on fruit and vegetable intake among students

3.4 Discussion

Numerous positive outcomes were associated with GBNE at Janesville and Gilsonville (Table 5). Because this study was based in a grounded-theory approach, data were collected with the intent of theory development (Corbin & Strauss, 1990). Research questions were broad in order to allow themes to emerge naturally within the data.

Most of the outcomes associated with GBNE at Janesville and Gilsonville have previously been described in the literature. A comprehensive analysis, however, providing an integrated model of GBNE's numerous outcomes and how they relate to students' fruit and vegetable intake has not previously been addressed.

The outcome most commonly described by interview participants in this study was the hands-on, experiential nature of GBNE, an outcome included under "Enhanced School Learning Experience". Two components of "Enhanced School Learning Experience", academic and cross-curricular integration have previously been identified as outcomes of GBNE, however a specific description of the hands-on nature of garden-based learning has not been documented as an explicit outcome of GBNE (Graham et al., 2005a; Graham & Zidenberg-Cherr, 2005b).

Improved nutrition knowledge, attitudes and behaviors, especially with regard to fruits and vegetables, are also established outcomes of GBNE (Lineberger & Zajicek, 2000; Heim et al., 2009; Ratcliffe et al., 2011; Parmer et al., 2009; Somerset & Markwell, 2008; Morgan et al., 2010). School gardens have been shown to provide students with enriching life experiences and also to nurture feelings of joy and wonder among students and staff (Thorp, 2001; Alexander et al., 1995). Gardens have also been described as therapeutic environments that reduce stress and that facilitate character development, for example learning social skills (Aldridge & Sempik, 2002; Graham & Zidenberg-Cherr, 2005b; Ober Allen et al., 2008). And finally, gardens and

green spaces facilitate meaningful interactions between peers and between youth and adults (Taylor et al., 1998; Ober Allen et al., 2008).

In this proposed contextual model, character development, relationships based on an experience with food, enjoyment and wonder, contextualized nutrition knowledge, and availability and exposure to fruits and vegetables in during GBNE lessons lead indirectly (via improved preference for and willingness to try) and directly to improved fruit and vegetable intake. A key identifies each outcome as an intrapersonal, interpersonal, or physical environmental factor. The intermediate outcomes and their links with improved preference for and increased intake of fruits and vegetables comprise a hypothesis for the routes through which GBNE leads to increased fruit and vegetable intake among students.

Determinants of food preference among children are complex, including: genetics, experience with food during infancy and early childhood, exposure, availability and accessibility to food, and peer and adult influences and modeling (Birch & Fisher, 1997). In light of these factors, several outcomes of GBNE found in this study were linked with students' preference for and willingness to try fruits and vegetables. These outcomes are: relationships based on an experience with food, sharing food with community, ownership enjoyment and wonder in the garden, and availability and exposure to fruits and during garden-based nutrition lessons. Additionally, increased availability and accessibility to fruits and vegetable has been associated directly with increased intake, as shown in the conceptual model (Story et al., 2002).

The ability to set goals is an important component determinant of an individual's ability to achieve behavior change (Contento, 2007). Positive outcome expectations and high self-efficacy lead to an individual's ability to set goals, a necessary step in achieving behavior change (Contento, 2007). Additionally, several studies have linked self-efficacy with fruit and vegetable

intake among children (Brug et al., 2008; Kristjansdottir et al., 2006). Improved self-efficacy resulting from the hands-on learning experience (Carver, 1996) in the garden may lead to students' improved ability to set goals, which may ultimately result in improved fruit and vegetable intake. Also, engaging in gardening, which itself is a long-term process, may enhance students' understanding of outcomes resulting from long-term goals. For this reason, the outcome "Character Development" was linked directly with increased fruit and vegetable intake.

A final outcome, improved nutrition knowledge has also been described as a contributor to nutrition-related behavior change (Story et al., 2002; Contento, 2007). The SCT, SEM, and even the KAB models posit that improved nutrition knowledge either directly or indirectly leads to changes in eating behavior (Story et al., 2002; Contento, 2007). For this reason, improved nutrition knowledge was linked to increased preference for, willingness to try, and intake of fruits and vegetables. In her description of the impact of increased knowledge on nutrition-related behaviors, Contento (2007) explained that the majority of nutrition education programs lead to increased instrumental, or "how to" knowledge. Garden-based learning may facilitate increased instrumental knowledge and may also increase knowledge associated with personal outcome expectations, also known as "why to" knowledge. Understanding the types of knowledge that GBNE imparts may be useful for researchers seeking to understand how improved nutrition knowledge as a result of GBNE affects students' fruit and vegetable intake.

It is clear that gardening enhances the traditional classroom-based nutrition education experience. This study identifies multiple outcomes associated with GBNE and is the first to synthesize these outcomes into a model explaining the effect of GBNE on students' fruit and vegetable intake. Also, this is the first study to address the theoretical foundations of experiential learning as relevant to the nutrition-related outcomes of GBNE. The hypothesis regarding the

routes through which GBNE leads to increased fruit and vegetable intake among students, which is presented in the form of the final conceptual model, provides an important theoretical framework for the future study of the dietary outcomes of GBNE.

3.5 Validity Criteria

Several validity criteria were used to measure the quality of this research. First, method triangulation was achieved by employing multiple modes of data collection among a diverse group of participants within each school (Lincoln & Guba, 1985). Data from: (1) interviews, (2) retrospective field notes taken after participant observation sessions, and (3) collection and analysis of student work, provided complimentary accounts of the GBNE experiences at the two schools. Reciprocity, as defined by Lincoln (1995), was achieved by building relationships based on trust and mutual respect between the researcher and participants at both schools (Lincoln, 1995). Catalytic validity, or "the degree to which the research process reorients, focuses, and energizes participants toward knowing reality in order to transform it", was also achieved (Lather, 1986, p. 272). During the process of interviews and observation, numerous participants, especially those who were not engaged in the garden, asked the researcher, questions about *their* gardens. These participants expressed excitement in learning about the gardens and indicated that they planned to seek further information. One of the goals of this study was to provide useful information for the successful implementation of school gardens. By engaging participants in discussion about their perceptions of and experiences with the gardens, this research project served as a catalyst for participants themselves to explore their gardens.

3.6 Limitations and Strengths

This study has several limitations. The self-selecting process of interview participant recruitment may have led to respondent bias. Also, participant observation was conducted between September and December. By conducting participant observation over the course of entire growing season, data may have more closely represented the gardening experience at Janesville and Gilsonville.

This study also has several strengths, including achievement of method triangulation, catalytic validity and reciprocity (Lincoln & Guba, 1985; Lincoln, 1995; Lather, 1986). The study findings were based on multiple modes of data collection, including 22 semi-structured interviews, 135 hours of participant observation and collection of student work.

3.7 Conclusions

GBNE at two Midwestern elementary schools was associated with numerous positive outcomes. These outcomes did not occur in isolation of one another; rather, the outcomes were interconnected. Examining the relationships between the numerous outcomes associated with GBNE can lead to better understanding of how the hands-on gardening experience leads to improved fruit and vegetable intake among students and to improved methods of nutrition education delivery.

3.8 Human Subjects Approval Statement

This study was approved by the Michigan State University Institutional Review Board.

CHAPTER 4

Lessons from the Garden: Perceived Facilitators and Barriers to School Garden-Based Nutrition Education at Two Elementary Schools

ABSTRACT

Background: Garden-based nutrition education, especially within schools, has gained popularity in recent years. Research suggests that school GBNE positively impacts students' knowledge about, preference for and intake of fruits and especially vegetables. This study explored perceived facilitators and barriers to GBNE at two elementary schools in the Midwest.

Methods: A case-study approach consisting of semi-structured interviews and indoor-classroom and outdoor-garden participant observation was utilized. Twenty-two semi-structured interviews were conducted with classroom teachers, nutrition educators, food service staff, administrators and other staff at the two schools. Participant observation was conducted with classroom teachers, nutrition educators and students, and field notes were recorded. Interviews and field notes were coded and analyzed through a naturalistic process based in grounded-theory. This paper discusses features identified within the emergent theme – facilitators and barriers to school GBNE

Results: Four categories of facilitators and seven categories of barriers to school GBNE emerged from the data. Facilitators included: (1) funding and community support, (2) presence of a garden champion and garden allies, (3) communication and school support, and (4) positive student feedback. Barriers included: (1) limitations in garden design, (2) seasonal limitations, (3) vandalism, (4) funding restrictions, (5) time constraints, (6) large classes, behavior problems and perceived lack of control, and (7) limited communication. Several of these facilitators and

barriers were experiences shared by participants at both schools whereas others were experiences unique to an individual school.

Conclusion: Numerous perceived facilitators and barriers to school GBNE were identified at two Midwestern elementary schools. These findings highlight potential issues for interested schools and school garden supporters to consider while planning and implementing GBNE programs.

4.1 Background

Fruits and vegetables play a protective role against the development of heart disease and certain cancers (Bazzano et al., 2002; Joshipura et al., 2001). Establishing adequate fruit and vegetable intake during childhood is an important step in promoting lifelong intake (Nicklas et al., 2001; Westenhoefer, 2002; Fisher & Birch, 2001; Mikkila et al., 2005; Singer et al., 1995). Currently, American children consume inadequate amounts of fruits and vegetables (Guenther et al., 2006). Methods for encouraging increased consumption of fruits and vegetables among youth are needed.

A growing body of literature suggests that in-school and extracurricular garden-based learning leads to improved knowledge of, preference for and intake of fruit and especially vegetables among youth (Lineberger & Zajicek, 2000; Parmer et al., 2009; Morris & Zidenberg-Cherr, 2002; Heim et al., 2009; Ratcliffe et al., 2009; Morgan et al., 2010; Somerset & Markwell, 2009). Despite the positive outcomes that school gardens foster among youth, researchers and practitioners face challenges to school garden implementation.

In two quantitative studies that examined administrator and teacher experiences with school gardens in California, participants reported practical challenges related to having and

using gardens. Reported barriers to school gardening included lack of time, lack of teacher interest, lack of experience with gardening, lack of curricular material linking gardening with academic standards, lack of teacher knowledge of gardening and lack of teacher training in gardening. Additionally, administrators from schools without gardens perceived barriers to having school gardens including lack of funding, lack of time and lack of gardening supplies (Graham et al., 2005a; Graham & Zidenberg-Cherr, 2005b). Alexander et al. also found that lack of time was a barrier to school gardening (Alexander et al., 1995).

The purpose of this article is to qualitatively explore facilitators and barriers associated with established GBNE programs at two elementary schools in the Midwest. Results may be used to guide the development and implementation of future GBNE intervention programs.

4.2 Methods

4.2.1 Study Design

This study employed a case-study approach, based in grounded-theory, with two elementary schools in the upper Midwest (Yin, 2003; Stake, 1995; Corbin & Strauss, 1990). Two schools were included in order to obtain robust data (Herriott & Firestone, 1983). Convenience and criteria for maximum variation purposive sampling were factors involved in selection of the two schools, Janesville Elementary and Gilsonville Elementary (Creswell, 2007). Inclusion criteria were: (1) presence of an established school garden, and (2) USDA SNAP-Ed grant funding, and (3) proximity to the research institution. Purposive variation between the two schools included: (1) percent of students eligible for SNAP benefits, (2) geographic and community characteristics, and (3) ethnic composition of the schools.

4.2.2 Sample and Data Collection

The principals at both schools agreed to have their schools participate in the study and letters of support were obtained. At both Janesville and Gilsonville, the researcher worked with a SNAP-Ed grant funded nutrition educator as the primary contact (USDA, 2010). Primary contacts at both schools facilitated communication between the researcher and other school staff and they also helped recruit interview and observation participants. Within each school, participants were included based on willingness to engage in semi-structured interviews, participant observation and spontaneous dialogue with the researcher. Participants were recruited by word of mouth and invitation letters.

4.2.3 Interviews

Based on a review of the literature and on issues brought up by school and community garden-based nutrition educators at a regional round-table discussion, semi-structured interview guides were developed for teachers who were engaged in the garden, teachers who were not engaged in the garden, administrators, food service staff and custodial staff (Robinson-O'Brien et al., 2009; Graham et al., 2005a; Graham & Zidenberg-Cherr, 2005b; Blair, 2009; Thorp, 2001; Alexander et al., 1995; Canaris, 1995; Scott, 2011). Experts in school and community nutrition intervention and evaluation and in teacher/researcher collaborative relationships reviewed the interview guides for face and content validity. Two classroom teachers, not affiliated with Janesville or Gilsonville, but who worked in schools with similar demographics in the region also reviewed the guides. The interview guides were modified according to suggestions provided by the reviewers. Each interview guide contained four question categories, consisting of several broad reaching open-ended questions. The four question categories covered the following topics:

(1) overall knowledge of and experience with the garden, (2) knowledge of and experience with garden funding, (3) knowledge of and experience with school policies that impacted the garden, and (4) perception of school-wide acceptance of and support for the garden. Within each question category, several broad-reaching, open-ended questions were asked, followed, if necessary, by probing questions intended to elicit elaboration among interview participants. Table 4 provides an example of a question category, a broad open-ended question and probing questions that were asked during an administrator interview.

Adult interview participants included classroom teachers, nutrition educators, food service staff, custodial staff, school principals and one librarian. A total of twenty-two adults were interviewed. Following the interviews, participants received a $15 gift card. Interview participants ranged from individuals who were knowledgeable about and engaged with the gardens to those who knew very little about the gardens. Most interviews lasted between thirty and forty five minutes, however three of the twenty-two interviews lasted over one hour. Interviews were conducted in English, face-to-face, by one researcher and were audio recorded. Written, informed consent was obtained prior to all interviews.

4.2.4 Participant Observation

Participant observation sessions were conducted in both inside-classroom and outdoor-garden settings. The researcher engaged in classroom activities with students; assisted teachers with non-instruction related tasks, such as passing out materials to students; and recorded field notes after the observation sessions.

At Gilsonville, one nutrition educator, affiliated with a community-based organization, conducted once-monthly “push-in” style garden-based nutrition lessons in each classroom.

Garden-based nutrition lessons were not considered release time for classroom teachers. Therefore, at Gilsonville, students, the nutrition educator and classroom teachers were included in the participant observation sessions. At Janesville, one nutrition educator, who was employed by the district, led a weekly Nutrition special (NS) through which students left their home classrooms to participate in nutrition lessons in a separate nutrition classroom and in the garden. The nutrition special at Janesville was considered release time for classroom teachers. Therefore, at Janesville, classroom teachers were not included in participant observation sessions.

Classrooms for participant observation were selected based on convenience. School scheduling and teacher willingness to participate were key considerations. At Janesville, five classes - three fifth-grade classes, one second-grade class and one kindergarten class - were involved with participant observation. At Gilsonville, twelve classes, including at least one class from kindergarten through fifth-grade, were involved in participant observation.

A description of the study was read out loud to kindergarten through second-grade students. Third through fifth-grade students received a document describing the project in addition to a verbal description. Verbal consent for engaging in participant observation was obtained from kindergarten through second-grade students and written consent was obtained for third through fifth-grade students. Parental consent was obtained for students at Janesville. However, the researcher experienced difficulty in obtaining returned consent forms at Gilsonville, an experience shared by an organization that had previously worked with the school. Therefore the Michigan State University Institutional Review Board granted a waiver of parental consent based on the low risk nature of the study design and under the conditions that no identifying information would be collected from students and that all participating students

would provide either written or verbal assent. Written informed consent was also obtained from nutrition educators and classroom teachers who engaged in participant observation.

The researcher paid careful attention to her perceived role among students. In an attempt to separate herself from the associations that students made with the traditional school structure, the researcher did not engage in formal garden-based instruction or student discipline. This observation technique was based on Thorp's (2001) description of the willingness of children to share their garden experiences with a trusted adult with whom they did not associate the traditional confines and parameters of school (Thorp, 2001). In total, participant observation took place for 50 hours at Janesville and 85 hours at Gilsonville, during the months of September through December.

4.2.5 Data Analysis

Data were analyzed holistically, in that both schools were pooled as one unit of analysis for preliminary theme formation (Yin, 2003). A codebook was developed through a naturalistic process based in grounded-theory as described by Lincoln and Guba (1985) and Corbin and Strauss (1990) (Lincoln & Guba, 1985; Corbin & Strauss, 1990). Initially, five transcripts were read and open coded for emergent themes using ATLAS.ti 5.7.1 qualitative analysis software (ATLAS.ti, 2011). Final codes were developed by condensing and categorizing open codes into concise groups. Definitions, rules and in some cases, examples, were provided for final codes in order to guide the remaining coding process. Following development of the final codes, the five open coded transcripts were re-coded along with the remainder of the transcripts. In total, twenty-two interview transcripts and twenty-two field notes were coded. Final coding was not a static process – several code definitions were adjusted to better reflect emerging themes.

4.2.6 Validity Criteria

Validity criteria for this study included establishing method triangulation, reciprocity, and catalytic validity (Lincoln & Guba, 1985; Lincoln, 1995; Lather, 1986). Multiple methods of data collection, including (1) semi-structured interviews, and (2) participant observation were conducted in order to establish method triangulation (Lincoln & Guba, 1985). Reciprocity was established by developing relationships based on trust and mutuality with participants (Lincoln, 1995). Catalytic validity, or "the degree to which the research process reorients, focuses, and energizes participants toward knowing reality in order to transform it" was also achieved (Lather, 1986, p. 272). During the course of the study, participants asked the researcher numerous questions about *their own* gardens. They expressed interest in learning more about this unique resource available at their schools. Because one of the aims of the study was to provide useful information for the successful implementation of school gardens, the fact that the study inspired participants to learn more about their gardens was considered a strength.

Table 4. Questions from School Administrator Interview Guide

Question Category	Overall knowledge of and experience with the garden
Broad Question	I'd like to talk with you about your school's garden. Can you tell me about the garden?
Probe Questions	10. What do you think about you school's garden? 11. How long has your school had a garden? 12. How was the decision made to start the garden 13. How is the garden used at your school 14. Do you think that using the garden is effective in teaching curricular subjects such as math or language arts? Why or why not? 15. Is the garden used for nutrition education? Do you think that the garden is an effective tool for teaching nutrition? Why or why not? 16. Do you think that using the garden as a teaching tool has advantages over other methods of student engagement? Describe the advantage(s) you have experienced. Is this (advantage) a reason that you support the garden? 17. Does using the garden have limitations compared to other methods of student engagement? What have you experienced as limitations of using the garden? 18. Overall, do you support the garden at your school? If so, why? If not, why not? How do you communicate your support or lack of support?

4.3 Results –Facilitators and Barriers to School Garden-Based Nutrition Education

The GBNE programs at Janesville and Gilsonville relied heavily on USDA SNAP-Ed grant funding. These federal grants supported nutrition educators' salaries at both schools. At Janesville, one full-time nutrition educator, hired by the school district, planned and led weekly garden-based nutrition lessons for all elementary students. A second nutrition educator, who worked primarily with high school students and occasionally with elementary students served as the USDA SNAP-Ed grant administrator for the Janesville school district. At Gilsonville, one nutrition educator, employed by a community non-profit organization, planned and led monthly garden-based nutrition lessons in every classroom. A second nutrition educator, who planned nutrition lessons and led Gilsonville's summer garden camp, served as Gilsonville's USDA SNAP-Ed grant administrator. Table 3 provides a description of key characteristics of the GBNE programs at Janesville and Gilsonville.

Two overarching themes associated with school GBNE emerged: (1) perceived and experienced outcomes, and (2) facilitators and barriers to school GBNE. This paper discusses features identified with the second theme, perceived facilitators and barriers GBNE (Table 6).

Following the emergence of facilitators and barriers to GBNE as an overarching theme, four categories of facilitators and seven categories of barriers to GBNE were identified. Facilitators included: (1) funding and community support, (2) presence of a garden champion and garden allies, (3) communication and school support, and (4) positive student feedback. Barriers included: (1) limitations in garden design, (2) seasonal limitations, (3) vandalism, (4) funding restrictions, (5) time constraints, (6) large classes, behavior problems and perceived lack of control, and (7) limited communication.

Table 3. Descriptive Information: District, School, and Garden Program

	Gilsonville Elementary	Janesville Elementary
District *		
School District Population	122,593	5,651
School District Race/Ethnicity	66.7% White 24.0% Black or African American 0.8% American Indian or Alaska Native 3.9% Asian 13.0% Hispanic or Latino (of any race)	98.4% White 0.5% Black or African American 0.6% American Indian or Alaska Native 0.09% Asian 1.5% Hispanic or Latino (of any race)
School **		
Number of Students	354	514
% Students SNAP Eligible	97.2%	64.5%
% Students ELL	60.2%	0%
% Students Special Education	4.5%	6.8%
Garden Program		
Physical Layout	Outdoor Garden and hoophouse	Outdoor garden, farm program with livestock on pasture, and greenhouse
Nutrition/Garden Educator(s)	Employed by community organization, two full-time nutrition educators, over 30 volunteers	Employed by the district, 2 full-time nutrition educators
Frequency of Garden Activities	Monthly in homeroom (all students), Weekly after school (5-10 students)	Weekly in nutrition classroom
Adult Semi-Structured Interview Participants	4 Classroom Teachers, 1 Literacy Special Teacher, 2 Nutrition Educators, 2 Food Service Staff, 2 Custodial Staff, 1 Principal	4 Classroom Teachers, 1 Literacy Special Teacher, 2 Nutrition Educators, 1 Food Service Staff, 1 Librarian, 1 Principal
Adult Observation Participants	15	1
Student Observation Participants	260	114

* Data from US Census American Fact Finder (United States Census Bureau, 2011)
** Data provided by the school principal

Table 6. Perceived Facilitators and Barriers to School Garden-Based Nutrition Education

Overall Facilitators	**Specific Facilitators** (# of Interview Participants to Describe Facilitator or Barrier, **# of Field Notes to Describe Facilitator**)
Funding and Community Support	1. Financial, in-kind and volunteer support (6) 2. Grant Administrator (4)
Garden Champion and Garden Allies	1. Dedicated individuals who invest extra effort in garden (9)
Communication and School Support	1. Adequate communication and associated support between garden/food service programs * (9) 2. Communication of administrative support (18)
Positive Student Feedback	3. Positive reaction to student excitement and interest in GBNE (6)
Overall Barriers	**Specific Barriers (# of Participants to Describe Barrier, # of Field Notes to Describe Barrier)**
Limitations in Garden Design	1. Space (3) 2. Distance between garden and school building * (4)
Seasonal Barriers	1. School year and growing season do not coincide (4)
Vandalism **	1. Vandalism to garden structure ** (4)
Funding Restrictions	1. Restrictions set by grantors (3, **1**) 2. Few grant opportunities for established school gardens (1)
Time Constraints	1. More time needed in garden ** (6, **3**) 2. Teachers' lack of time (11, **1**) • Teachers' lack of time due to mandated teaching requirements (6)
Large Classes, Behavior Problems, Lack of Control	1. Large classes (4, **1**) 2. Perceived and experienced problems with student behavior (6, **1**) 3. Perceived lack of control in outdoor-garden setting (2)
Limited Communication **	1. Limited communication and lack of support between garden and food service programs ** (3)

* Described only at Janesville ** Described only at Gilsonville

4.3.1 Facilitators to School Garden-Based Nutrition Education

4.3.1.1 Facilitator: Funding and Community Support

Two factors associated with funding were identified as facilitators to GBNE. These factors were: (1) financial, in-kind and volunteer support, and (2) the presence of a dedicated funding administrator.

Multiple sources of support (financial and in-kind) allowed the schools to meet specific requirements set by major grantors while also accommodating the diverse, and occasionally unexpected, demands of the gardens. For example, the purchase of cooking supplies used to prepare produce from the garden for tasting was allowable through USDA SNAP-Ed funds; however the purchase of seedlings and gardening supplies such as tools was restricted. At Janesville, additional grants and collaboration with the local high school's Agriscience program were resources through which garden materials such as seeds, compost and tools were obtained. At Gilsonville, the non-profit organization that ran the garden received donations from a local community gardening organization and from individual community members. Community support consisted of monetary donations; in-kind donations such as plants, compost and mulch; and volunteer time.

At both schools, having one of the nutrition educators serve as the grant and funding administrator enabled the other teachers and administrators the freedom from grant reporting requirements. Additional factors associated with funding were described as barriers to GBNE at both schools. These factors will be introduced in the "Barriers" section of this paper.

4.3.1.2 Facilitator: Presence of Garden Champions and Garden Allies

Interview participants at both schools identified the presence of garden champions as a facilitator to GBNE. This term, used by one of the educators at Janesville, refers to dedicated individuals who invest extra effort and time, often unpaid, to ensure garden success. According to this definition, garden champions included school employees, employees of a community-based organization and community volunteers. Garden champions spent time maintaining, promoting the use of and recruiting additional helpers for the school gardens.

Garden champions from both schools described making an extra effort, including working extra hours, in order to maintain and promote the gardens. For example, a classroom teacher at Janesville, described a garden champion investing extra effort:

> [The garden champion] *is GREAT about — I mean, she goes way above and beyond and she'll just do — she's done a ton. I couldn't even tell you half the things she's done. I don't even know about them. She just does them. So she's done a lot of projects with teachers because I don't have the time in my schedule and so she'll just do them.*

In another interview, a teacher at Janesville explained that having the garden champions constantly promoting GBNE was a factor that facilitated teachers' participation.

> *If you have somebody from the* [GBNE] *program coming to you and saying 'Hey, this is something that you can do, please come do it', then I'm totally in. But a lot of the teachers won't think on their own to say, 'Oh, maybe this would be a good idea' …. So unless you physically have somebody to tell you — that's how I am sometimes. And when* [the garden champion] *comes in and says 'Hey, how about we do this'… 'Okay, why not?' But to take extra time out and to plan on your own and all these little things, we just don't do. And that's just honest. That's how teachers are.*

This teacher went on to explain: "*I mean, they* [the garden champions] *work their butts off to try and figure stuff out for us …. To have a person in your face telling you what's available, it's important for me. Otherwise I don't take advantage of it."*

In addition to the presence of garden champions, the researcher noted the presence of individuals identified as garden allies. Garden allies did not have time to actively maintain or promote use of the gardens; however they provided encouragement and support to the garden champions. By welcoming and enthusiastically engaging in garden activities, garden allies fed the garden champions' sense of excitement for and motivation to promote GBNE at the schools. Three interview participants, including garden champions from both schools, identified teachers, administrators and other school staff who were especially supportive of GBNE.

4.3.1.3 Facilitator: Communication and School Support

Communication emerged as a facilitator to GBNE, both between the garden-based nutrition program and (1) the food service program at Janesville, and (2) school principals at both Janesville and Gilsonville.

Food Service Communication and Support - Janesville

At Janesville, interview participants described numerous occasions in which the food service and garden programs had worked together. Nutrition educators indicated that the school's food service staff were extremely supportive of the garden program, and likewise, the food service staff member indicated that the nutrition educators who ran the school garden were respectful and friendly. Participants described communication and respect as keys to the positive

relationship. For example, one nutrition educator mentioned that she paid special attention to maintaining a positive relationship with the food service program.

> *Our kitchen staff has been great … 'cause they've got the big sinks for washing dishes and they just - 'Whatever, come on in' …. I have to work around my schedule sometimes. And around when they're super busy, I try to stay out of their way …. So it's just a matter of trying to be respectful of each other's space. And I'm always thanking them and making sure they get tastes of whatever we're doing … And they just are really really great.*

A food service staff member provided a similar description.

> *The staff that worked it* [the garden] *were very friendly … They were helpful, you know. They'd always come in and ask first … if they had to use the oven for the day, they'd come in and make sure it was okay … They were great as far as being, as far as trying to accommodate with us to make sure that it wasn't going to be, you know, they weren't going to be in our way.*

In an example of the two programs working together, a food service staff member described an occasion when produce from the garden was used to supplement the school lunch.

> *There was one time during the summer that I was, I didn't have something I needed. So they were scrambling to try to find anything I could use. I needed some green pepper, tomato … So they went to both their gardens that they had and tried to find everything that they could to help me out. And so, they were very, very helpful.*

Additional examples of the synergy between the food service and garden programs were (1) addition of organic waste from food service to garden compost, and (2) incorporation of spinach

from the garden into the salad bar. A working relationship based on clear communication and respect played a role in facilitating this successful partnership at Janesville.

Administrative Communication and Support – Janesville and Gilsonville

Over half of the interview participants perceived strong administrative support for GBNE at both schools; however these participants were unable to provide specific examples of how administrators communicated their support. Similarly, the school principals confirmed that they valued and strongly supported the GBNE programs; however they indicated that they communicated their support in an informal manner. For example, the principal at one of the schools described a relaxed approach to communicating her support for GBNE.

Researcher: Do you support the garden?

Principal: Yes, definitely.

Researcher: …. How do you communicate that support or make that known that you think that the garden is a good thing at the school?

Principal: I don't know how. I don't know if I really communicate it that well. Except just in talking to the people that are in charge, the nutrition teachers and the coordinator …. We're pretty easygoing. I'm not rigid. So that's probably the biggest positive with them. I'm just not rigid about most things, if you can teach something.

The principal at another school described a similar informal approach to support: "*Principal: I think there's, not rules so much that inhibit the garden or rules that support it, but, the support is there in* [the school] *having its doors open to the garden."*

4.3.1.4 Facilitator: Positive Student Feedback

The previous three facilitators to GBNE – funding, garden champions and allies, and communication and school support - were factors dependent upon staff at the schools. Numerous benefits to students have been associated with GBNE at Janesville and Gilsonville (Martin, 2011); however, students at these schools also played an important role in actively facilitating GBNE at their schools. Positive student feedback was a facilitator to GBNE at both schools.

Interview participants, field notes, and examples of student work provided descriptions of students' interest and enjoyment in GBNE. Additionally, several interview participants, all of whom were identified as either garden champions or allies, explained that they responded positively to students' excitement for and interest in GBNE. Positive student feedback emerged as a factor that influenced teachers' decisions to use the gardens at both schools. For example, when describing recruitment for participation in GBNE, a nutrition educator (NE) at Gilsonville explained that student feedback was her most valuable tool.

> *Researcher: What's your way of trying to get the word out* [about the garden] *at Gilsonville?*
>
> *NE: A lot of it just kind of has to do with my connection with the kids, actually. Because the kids enjoy our program so much, they are the first testimonial that we have. And the best and the brightest testimonial.*

In another example, a classroom teacher at Gilsonville indicated that student excitement and interest were factors involved in her interest in the garden.

> *Researcher: Why are you interested in the garden?*

Teacher: I just, the excitement from the kids is just great. And then when you go out and see them in the garden …. It's nature, you know, where they can see how food is grown, and healthy food. And they just have a great interest and excitement for it.

Positive student feedback also provided encouragement and motivation to garden champions. For example, one of the garden champions at Janesville described taking pleasure in the fact that students were willing to try new foods: *"I love it because kids are eating food that I never thought they would touch."* A nutrition educator and garden champion from Gilsonville described that students excitement for the garden made the challenges involved with GBNE "worth it."

I still believe that it's worth it. Even though there's … so much labor involved in getting the soil and getting the plants and getting the woodchips and watering, and arranging, all that is worth it to see all those kids running out to the hoophouse screaming 'Spinach!'

4.3.2 Barriers to School Garden-Based Nutrition Education

4.3.2.1 Barrier: Limitations in Garden Design

The two most commonly described limitations in garden design were: (1) lack of adequate space, and (2) distance between the school and the garden.

Interview participants from both schools indicated that inadequate space in the garden structures was a barrier to effective GBNE. For example, at Janesville, an educator expressed her desire for each class to have their own dedicated garden bed within the greenhouse. With classroom specific garden beds, she explained, students could track and monitor plants that they

had planted, as opposed to students tending a more "corporate", or shared, garden space. At Gilsonville, two teachers described difficulty in keeping students from trampling through the ground-level garden beds in the hoophouse. Installing raised beds or widening pathways are adjustments in garden design that could alleviate these perceived barriers.

Additionally, four participants, all from Janesville, explained that the distance between the garden and the school building, approximately 800 feet, was a factor that kept teachers from engaging in GBNE. For example, a classroom teacher at Janesville explained: *"One barrier that I see is that it's too far from my classroom. If I could get there quicker, I would get there more."*

4.3.2.2 Barrier: Seasonal Limitations

Seasonal limitations were described by interview participants from both schools, even with the presence of a greenhouse at Janesville and a hoophouse at Gilsonville. These participants noted that the relatively short growing season experienced in the upper Midwest was not ideal for school gardening, mainly because the growing season and the school year did not coincide.

4.3.2.3 Barrier: Vandalism - Gilsonville

Four interview participants at Gilsonville, including both nutrition educators, a custodian and the school principal, described vandalism as a barrier to GBNE. They explained that several neighborhood youth, on multiple occasions, had torn the plastic walls of the hoophouse using sticks and also by physically climbing up the sides of the structure. Vandalism may have been an issue at Gilsonville, in part, due to the location of the garden. The school was situated in the

heart of a high-traffic urban neighborhood. The garden sat in plain view of passers-by, which, was seen by participants, not only as a barrier, but also as a positive attribute of the garden. The garden had a "Community Tomatoes" section, which was planted specifically for and enjoyed by community members. In addition to its positive neighborhood contribution, however, the open and easily accessible setting of the garden may have also increased its vulnerability to potential vandalism.

Despite the challenges associated with vandalism, participants at Gilsonville exhibited hopefulness and resilience. For example, one participant explained:

> *We're always heartbroken when it* [the garden] *gets vandalized, but the kids in the school and the neighborhood actually also know who hurts the garden. So they're paying attention to it. It's really nice.*

In another example, a participant at Gilsonville expressed her thoughts regarding garden vandalism:

> [You can work] *so hard to bring this program to them and then they're turning around and destroying it … But that's just one or two bad kids out of the 250 kids at the school. …. You can't let that one or two destroy the all. That's what's wrong with this whole world right now. You know, you just can't go there. So I've been really trying not to let it get to me. Even though it's really, really frustrating to have stuff you work so hard on destroyed just so simple and easily.*

4.3.2.4 Barrier: Funding Restrictions

The nutrition educators from both Janesville and Gilsonville perceived barriers to GBNE associated with funding restrictions. These participants explained that guidelines regarding

allowable and unallowable expenditures accompanied the SNAP-Ed federal grants that funded the GBNE programs. The nutrition educators expressed concerns regarding allowable and unallowable expenditures. For example, one participant explained her dissatisfaction with the SNAP-Ed grant's restriction on direct garden-related expenditures:

> *I understand that the money is coming from the USDA and it's supposed to be helping people increase their nutrition, but I just have a different view of that. I see it as … the more kids are comfortable around food and exposed to food in a general way, then they might be more willing to eat it and to try it …. I just think that being a little more broad and a little more holistic, because I think it's a very pigeon-holed view of how you teach people about nutrition.*

Another nutrition educator expressed a similar sentiment.

> *They* [the grantor] *understand that gardens support behavior change, but they're not willing to support gardens as a way to support behavior change. So, so I'm in a pickle. How much time and labor and energy goes into the gardens, and recruiting the volunteers to do that? Because I'm not supposed to do that labor unless I clock out and I'm volunteering. And so that's the whole aspect of it that makes it a downfall.*

Other limitations associated with funding included a relative scarcity of grants available to established school gardens. One participant, the grant administrator at Gilsonville, explained that grants for start-up gardens were offered much more frequently than grants designed to support established gardens. The issue of funding emerged as a double edged sword at Janesville and Gilsonville. Without generous support from grant funders, the programs would not exist; however, nutrition educators perceived restrictions imposed by the funding agencies as barriers to GBNE.

4.3.2.5 Barrier: Time Constraints

Time constraints also emerged as a barrier to GBNE. At Gilsonville interview participants and several field notes from participant observation described the need for students to spend more time in the garden. At both schools, interview participants and field notes cited that the main barrier to teachers participating in GBNE was lack of time, with over half of these interview participants referring to lack of time specifically due to mandated teaching requirements.

The non-profit organization that supported Gilsonville's garden also supported gardens at three other local elementary schools. Several years earlier, when the community organization began their GBNE program, Gilsonville was the only school involved. At that time, the organization provided weekly garden-based nutrition lessons to the students in addition to a weekly after-school garden club. Since that time, the community organization expanded to support three additional school gardens. Due to the expansion, the frequency of GBNE at Gilsonville was reduced to once monthly instead of once weekly. Participants' dissatisfaction with the reduction of students' garden time emerged from the data. For example, a classroom teacher at Gilsonville shared her regret regarding reduction of students' time spent in the garden. She indicated that the reduced frequency of garden-based lessons made the learning experience less continuous. With an entire month passing between lessons, she explained, it was difficult for students to make connections to previous lessons.

Teacher: Well they [the nutrition educators] *were here a lot more, yeah. Now, once a month. That seems like, isn't really enough, but.*

Researcher: How do you think that's changed the experience for the students?

Teacher: They don't get as much of it [GBNE] *and can't be - it's more like, 'Well here's a lesson on this. And here's a lesson.' You can't really say, 'Well last time we learned about, you know, because they're so far apart. And the kids will forget. But, it's changed in that way. And I wish they would do it* [GBNE] *more. But I know with all the funding not being there it's kind of hard. They would need to do it out of the goodness of their hearts.*

The nutrition educators at Gilsonville were aware of teachers' feelings regarding reduced garden time. One of the nutrition educators at Gilsonville described teachers' response to the reduced frequency of garden-based lessons:

In the beginning we were at Gilsonville every week and now we're there once a month. So the teachers there are quite upset that they don't get to see us the other three weeks. And we're not able to teach as much. So our way around that is we tell the teachers about the curriculum and we leave a copy of the curriculum and we encourage them to use it. But I'm not sure quite how often that's happening.

Students at Gilsonville also expressed the desire to spend more time engaging in GBNE. In a field note recorded during the once monthly garden week at Gilsonville, the researcher described an informal conversation with a group of students:

On Friday as I was walking between classes at the school, a few students in the hallway stopped to talk to me. These were fourth-grade boys. They asked me when we were coming back to do more cooking. I told them that the next time would be January. They both seemed surprised. One of the boys said, 'January! That's so far away! Why can't you come back sooner?' I told him that we have to go to other schools too. The other boy told me, 'I wish you would come here every week.'

In contrast to participants at Gilsonville, participants at Janesville did not express dissatisfaction with the amount of time that students spent engaging in GBNE. This contentment at Janesville was likely due to the fact that students engaged in GBNE on a weekly basis.

Participants at both schools cited teachers' lack of time, especially due to mandated teaching requirements, as a major barrier to GBNE. It was rare for teachers at Janesville or Gilsonville to engage in GBNE with their students independently of the nutrition educators. For example, a fifth-grade teacher at Janesville indicated that the demands associated with mandated curriculum kept her from engaging in GBNE with students:

> *As far as myself using it* [the garden]*, when it's not nutrition special time, probably not likely to happen because of all the mandated curriculum …. It's very hard to fit everything in the way it is, and so much of school funding relies on our teaching the kids what they're going to be required to know. The testing – it's hard to squeeze other things in.*

4.3.2.6 Barrier: Large Classes, Behavior Problems and Perceived Lack of Control

Participants from both schools described large classes, perceived and experienced problems with student behavior, and perceived lack of control as barriers to GBNE. Four participants described large class sizes, with numbers exceeding 25 students, as a barrier. Six participants described potential and experienced behavioral problems as a factor that led to teachers' lack of participation in GBNE. On a related note, two participants cited teachers' perceived lack of control associated with the outdoor-garden setting as a potential barrier to GBNE.

4.3.2.7 Barrier: Limited Communication- Gilsonville

A lack of effective communication between the garden and food service programs emerged as a barrier to GBNE at Gilsonville. As described by two nutrition educators and two food service staff members, the relationship between the two programs was not constructive. The nature of this relationship resulted, in part, from a mutual lack of communication about and understanding of each other's goals and needs.

Both food service staff members interviewed at Gilsonville expressed interest in the garden; however they knew very little about the purpose and structure of the garden program. For example, a food service staff member wondered out loud during her interview whether the garden belonged to the school or to a local community center (not affiliated with the non-profit organization that supported the garden). Due to a perceived lack of garden produce entering the school, this food service staff member believed that the garden may have been owned by the local community center rather than by the school.

> *I didn't know if the garden was part of here* [the school] *or part of the community center out there …. 'Cause they* [the garden program] *never donate nothing to here. But they probably gather it and take it up to the community center …. And then distribute it there … That always surprises me because it's so close to here …. And they use stuff from here. They use the kitchen; they use the stuff like that. So it would seem like they would want to donate some of the stuff to here.*

Although it became clear to the researcher over the course of the study that the garden program was not designed to provide a steady supply of produce to the food service operation, the food service staff were not aware of this limitation. One of the nutrition educators at Gilsonville described the production capacity of the garden program:

> *At the scale that we're currently at, we could supplement some of the items on their* [food service] *salad bar at certain parts of the year. But we haven't really pursued that because it makes much more sense for a farm-to-school program to come in so that they can actually bring in enough to supply the whole school with what they need …. But that's a lot farther from what our focus is - is mainly just nutrition education, not providing the salad bar or doing a farm-to-school. So, I would love for something like that to happen. I think at our current capacity, with our current funding source, I can't foresee a way to do that other than just supplementing one item when we have it.*

Had the food service staff at Gilsonville understood the purpose of the garden program (nutrition education), and understood its limited capacity for food production, frustration regarding not receiving produce from the garden may have been less of an issue. The food service staff spoke favorably about the idea of working with the garden program in a situation through which both parties would benefit.

Lack of communication also led to tension regarding the garden program's use of food service equipment, such as the oven or the dumpster. Time constraints imposed on the nutrition educators led to their inability to engage in relationship building and consistent communication with the food service staff. More consistent communication, including relationship building and timely requests for kitchen use, may help alleviate problems between the two programs.

4.4 Discussion

Numerous perceived facilitators and barriers to GBNE were identified at Janesville and Gilsonville. Several of these factors, such as the presence of garden champions (facilitator) or funding restrictions (barrier), were experiences shared at both schools. Additional facilitators and

barriers, for example, the distance between the school building and the garden (barrier at Janesville) and problems with vandalism (barrier at Gilsonville), were unique experiences described at individual schools. The variation in perceived and experienced facilitators and barriers to GBNE supports the notion that no single prescription can be made with regard to GBNE design or implementation. These reported facilitators and barriers may, however, provide useful insight for planning and implementation of successful GBNE programs.

Barriers to GBNE highlighted in this study, including lack of funding and lack of teacher time, were also reported in two studies conducted among California teachers and principals (Graham et al., 2005a; Graham & Zidenberg-Cherr, 2005b). Alexander et al. found that time constraints were a barrier to elementary school GBNE (Alexander et al., 1995). Limitations in garden design, vandalism and limited communication have not been previously discussed in the peer-reviewed school garden literature.

Several of the facilitators to GBNE described by participants at Janesville and Gilsonville mirror considerations described as "best practices" by Desmond, Grieshop and Subramanium (2002). In their report on the historical roots, best practices and outcomes of garden-based learning, Desmond et al. (2002) describe organizational considerations, such as engagement with classroom teachers and school administrators, as factors that facilitate the development of successful garden-based education programs. They also highlight the importance of considering garden design in the planning of educational gardens. Issues such as garden size, raised beds versus ground-level beds, indoor versus outdoor gardens and the specific plants that will be cultivated were mentioned as important operational considerations (Desmond, Grieshop & Subramanium, 2002). Additional facilitators to GBNE, including the presence of a dedicated garden coordinator and relationship building with the school principal and with "key teachers"

have been reported in the literature (Somerset & Markwell, 2008). The dedicated garden coordinator and "key teachers" described by Somerset & Markwell (2008) may be analogous to the garden champions and garden allies identified at Janesville and Gilsonville.

4.5 Recommendations for Practice

Several recommendations for practice can be gleaned from the experiences of participants at Janesville and Gilsonville. These include: (1) Identifying diverse sources of funding and potential funding administrators; (2) Engaging multiple shareholders within the school, including classroom teachers, food service staff, administrators and volunteers; (3) Developing means by which to support and encourage garden champions and allies; (4) Supporting classroom teachers' integration of garden-based activities into curricular teaching by providing resources through which mandated teaching requirements may be met while also engaging students in the garden; and (5) Considering issues such as space, shared versus classroom specific beds, raised versus ground-level beds, season extension and garden security when exploring potential garden location and design. For fledgling GBNE programs, addressing each of these recommendations will be no minor task. Programs may benefit by determining their unique assets and limitations and determining which of these recommendations are feasible to address.

4.6 Limitations and Strengths

This study has several limitations, including potential bias introduced by the self-selecting method of interview participant recruitment and the duration of participant observation, conducted between the months of September and December. A full year of participant

observation may have yielded richer data that more truly represented the GBNE experiences at the schools.

Strengths of this study include achievement of several forms of qualitative validity: method triangulation, catalytic validity and reciprocity (Lincoln & Guba, 1985; Lather, 1986; Lincoln, 1995). Additional strengths of this study were that over 135 hours of participant observation and 22 face-to-face interviews were conducted.

4.7 Conclusions

This study identified numerous factors as facilitators and barriers to GBNE. These factors are not an exhaustive list; rather, these insights highlight experiences associated with two unique school garden-based nutrition programs. Facilitators and barriers described by the participants at Janesville and Gilsonville, along with insights provided by other school garden programs, state extension programs and gardening associations may prove useful to educators and school garden supporters interested in planning and implementing successful GBNE programs.

4.8 Human Subjects Approval Statement

This study was approved by the Michigan State University Institutional Review Board.

CHAPTER 5: SUMMARY AND CONCLUSIONS

5.1 Summary

This research explored the school GBNE experience at two Midwestern elementary schools. Three methods of data collection - interviews, participant observation, and collection of student work were employed in order to address the following study aims.

5.2 Study Aims 1 and 2

Study Aim 1: To understand administrator, staff, and student experiences of school-based gardens in two elementary schools in the Midwest.

Study Aim 2: To understand the roles that these school gardens serve in two elementary schools in the Midwest.

Chapters 3 and 4 addressed Study Aims 1 and 2. Students and adults described positive experiences with and perceptions of the gardens. Between the two schools, the gardens were used for food and nutrition education, academic instruction, student character development, enhancement of students' life experiences, peer and intergenerational relationship building, community engagement, and student and staff enjoyment.

5.3 Study Aim 3

Study Aim 3: To understand the dynamic relationships between school personnel and how the garden fits into these relationships.

Study Aim 3 was addressed through interview participants' descriptions of communication and school support. It became clear that staff relationships had the potential to either enhance or inhibit the GBNE programs. Staff relationships based on clear communication and respect, such as those between the food service staff and nutrition educators at Janesville, were thought to contribute to the success of the garden. Conversely, staff relationships that lacked clear communication and mutual understanding were described as barriers to GBNE. Staff relationships within school settings are complex and the factors leading to issues such as adequate communication and school-wide support of garden programs warrant further study.

5.4 Study Aim 4

Study Aim 4: To understand how the student experience of the school gardens compare to why and how teachers and other staff use the garden.

The student experience of school gardens, referenced in Study Aim 4, was described in Chapter 3. This chapter provided descriptions of both perceived and witnessed student outcomes associated with GBNE. Perceived outcomes were described by adults as factors that led to their support for and use of the gardens. In several situations, adults' perceptions of the benefits of GBNE and students' actual experiences with GBNE coincided. Adults at the schools not only perceived that gardens *could* teach nutrition and academics, offer life experiences, and facilitate character development, but they also described actually witnessing these outcomes among students. Field notes resulting from participant observation sessions and examples of student work confirmed that students experienced the benefits reported by interview participants, especially nutrition-related and academic benefits. These findings suggest that students'

experiences with the school gardens mirrored the factors behind staff support for and engagement with GBNE.

5.5 Study Aim 5

Study Aim 5: To provide useful information regarding challenges and potential resources that should be considered when developing a school garden program.

In Chapter 4, recommendations were provided based on the facilitators and barriers to GBNE revealed at Janesville and Gilsonville. These recommendations included: (1) Identify diverse sources of funding and potential funding administrators; (2) Engage multiple shareholders within the school, including classroom teachers, food service staff, administrators and volunteers; (3) Develop means by which to support and encourage garden champions and allies; (4) Support classroom teachers integration' of garden-based nutrition into curricular teaching by providing resources through which mandated teaching requirements may be met while also engaging students in the garden; and (5) Consider issues such as space, shared versus classroom specific beds, raised versus ground-level beds, season extension and garden security when exploring potential garden location and design.

Because of the grounded-theory nature of this study, results reached beyond the boundaries of the original study aims (Corbin & Strauss, 1990). The results were summarized in two chapters to be submitted to research journals.

5.6 Perceived Outcomes Associated with Garden-Based Nutrition Education

In Chapter 3 seven overarching categories of perceived positive outcomes were presented, including: (1) enhanced school learning experience, (2) enhanced nutrition knowledge, attitudes and behaviors, (3) improved understanding of food systems, (4) character development, (5) enhanced life experience, (6) intergenerational relationships and community engagement, and (7) feelings of enjoyment, wonder and therapeutic effects among students and staff.

Numerous outcomes, including components from all seven groups of outcomes recognized in this study, have previously been identified as outcomes associated with garden-based learning or experiences in gardens and green spaces (Graham et al. 2005a; Graham & Zidenberg-Cherr, 2005b; Lineberger & Zajicek, 2000; Heim et al., 2009; Ratcliffe et al., 2011; Parmer et al., 2009; Somerset & Markwell, 2008; Morgan et al., 2010; Thorp, 2011; Alexander et al., 1995; Aldredge & Sempik, 2002; Taylor et al., 1998; Ober Allen et al., 2008).

The hands-on nature of garden-based learning was recognized as an important contributor to the influence of GBNE on student outcomes, including increased fruit and vegetable intake. Theories of experiential learning propose that hands-on, experience-based learning, allows learners to contextualize newly acquired knowledge and that experiential education leads to improved personal agency and competence (Kolb, 1984; Carver, 1996). In light of these factors, a grounded-theory conceptual model was developed explaining the effect of garden-based learning on nutrition education and on students' fruit and vegetable intake. In this model, garden-based learning provided a hands-on educational opportunity through which numerous intermediated outcomes associated with GBNE ultimately led to increased fruit and vegetable intake among children. Multiple research studies, including this one, indicate that GBNE leads to

increased fruit and vegetable intake (Lineberger & Zajicek, 2000; Heim et al., 2009; Ratcliffe et al., 2011; Parmer et al., 2009; Somerset & Markwell, 2008; Morgan et al., 2010). In Chapter 3, a data driven model and a conceptual model based on data and theory were provided. The conceptual model provides a hypothesis for the route through which GBNE leads to increased intake of fruits and vegetables among students.

This is the first comprehensive model hypothesizing how GBNE improves fruit and vegetable intake and is also the first description to include hands-on learning as a determinant of increased fruit and vegetable intake. Nutrition researchers often use established theories commonly associated with health behavior, such as the Social Cognitive Theory, to explain GBNE's effectiveness at increasing students' fruit and vegetable intake. Although GBNE is a form of educational instruction, the phenomenon has not been examined through the context of educational theories. Hands-on learning was integrated into the conceptual framework after examination of theories of experiential education revealed that hands-on experience-based learning leads to enhanced knowledge, self-efficacy, and skill (Carver, 1996; Kolb, 1984). Knowledge, self-efficacy and skill are factors that have been identified as determinants of fruit and vegetable intake among children (Brug et al., 2008; Kristjansdottir et al., 2006).

Garden-based learning provides a rich opportunity for enhancing the traditional classroom-based nutrition education experience. As was the case at Gilsonville and Janesville, students spent time learning about nutrition concepts in both the indoor-classroom and outdoor-garden environments. The hands-on nature of GBNE may be a key factor that contributes to the effectiveness of GBNE at improving students' nutrition behavior. Research examining the outcomes of GBNE may benefit from measuring the extent to which learning is actually hands-on or experiential. Measuring related constructs from the conceptual model, such as relationship

building, enjoyment, and change in fruit and vegetable availability at school, may also further elucidate the mode through which GBNE improves students' fruit and vegetable intake.

5.7 Perceived Facilitators and Barriers to Garden-Based Nutrition Education

Chapter 4 described four categories of facilitators, and seven categories of barriers associated with GBNE at Janesville at Gilsonville. Facilitators included: (1) funding and community support, (2) presence of a garden champion and garden allies, (3) communication and school support, and (4) positive student feedback. Barriers included: (1) limitations in garden design, (2) seasonal limitations, (3) vandalism, (4) funding restrictions, (5) time constraints, (6) large classes, behavior problems and perceived lack of control, and (7) limited communication.

In addition to development of a grounded-theory conceptual model, this study also provided practical recommendations for the implementation of GBNE programs. These recommendations were based on the perceived facilitators and barriers to GBNE revealed at Janesville and Gilsonville. These recommendations included: (1) identifying diverse sources of funding and potential funding administrators; (2) engaging multiple shareholders within the school, including classroom teachers, food service staff, administrators and volunteers; (3) developing means by which to support and encourage garden champions and allies; (4) supporting classroom teachers integration' of garden-based nutrition into curricular teaching by providing resources through which mandated teaching requirements may be met while also engaging students in the garden; and (5) considering issues such as space, shared versus classroom specific beds, raised versus ground-level beds, season extension and garden security when exploring potential garden location and design. Desmond et al. offer similar recommendations in their report on gardens in education (Desmond et al., 2002). Facilitators and

barriers to GBNE have not been the focus of peer-reviewed reports on GBNE. Based on the findings that GBNE serves as an effective tool for improving fruit and vegetable intake among students, recommendations for the effective implementation of GBNE programming are warranted. The recommendations provided in this study were determined based on issues faced by established GBNE programs and many of the facilitators and barriers were common to both urban and rural programs.

When planning and implementing GBNE programs, researchers and practitioners may benefit from examining previously described facilitators and barriers to GBNE and determining which factors are relevant to their unique programs. For example, an urban school may potentially experience problems with vandalism (as described at Gilsonville). The recommendations included in Chapter 4 provide a guide for planning and implementation of future GBNE programs.

5.8 Limitations and Strengths

This study had several limitations, including potential bias among self-selected interview participants. The extent to which these participants were biased is unclear, however, it should be noted that interview participants ranged from school staff who were very engaged with the garden programs to one participant who did not even know that the school had a garden. A second limitation has to do with the timing of the study. Due to time constraints, the researcher conducted participant observation for only three months, early September through early December. The gardens were located in the upper Midwest, and therefore observations were made toward the end of the growing season. Participants indicated that the school gardens were

used more often during the spring and summer months. Therefore, additional participant observation sessions, especially early in the growing season, may have enriched the data.

This study also had several strengths, or validity criteria, against which quality may be assessed. Validity criteria achieved by this study were: (1) method triangulation, (2) reciprocity, and (3) catalytic validity.

Multiple modes of data collection were used in order to achieve method triangulation and data collection continued at both schools until saturation was achieved (Lincoln & Guba, 1985). Lincoln and Guba (1985) explain the benefit of method triangulation: "It is as though a fisherman were to use multiple nets, each of which has a complement of holes, but placed together so that the holes in one net were covered by intact portions of other nets" (Lincoln & Guba, 1985, p. 306). Themes were determined following analysis of field notes and interview transcripts. Student work provided additional support for several of the themes. Method triangulation does not require that all data sources mutually confirm all findings. Through method triangulation, data that may not have been captured by one mode of data collection may effectively be captured by a different mode (Lincoln and Guba, 1985).

Reciprocity was an additional criterion for validity achieved by this study. Through a process of clear communication and respect, relationships were built between the researcher and participants. These relationships led to the establishment of reciprocity, or a sense of trust, caring, and mutuality between the researcher and study participants (Lincoln, 1995). In addition to formal data collection activities, the researcher socialized with teachers during breaks (i.e. during lunch hour) and spent time outside of the formal data collection setting building relationships with staff at the schools. By establishing relationships with adult participants based on mutual respect and trust, these participants freely shared opinions and ideas during interview

and observations sessions. The researcher also paid careful attention to her relationship with and perceived role among students. In an attempt to separate herself from the associations that students made with the traditional school structure, the researcher did not engage in formal garden-based instruction or student discipline. This technique was based on Thorp's (2001) description of the willingness of children to share their garden experiences with a trusted adult with whom they did not associate the traditional confines and parameters of school (Thorp, 2001)

Catalytic validity, or "the degree to which the research process reorients, focuses, and energizes participants toward knowing reality in order to transform it" was an additional strength of the study (Lather, 1986, p. 272). During the process of interviews and observation, numerous participants, especially those who were not previously engaged in the garden, asked the researcher, questions about *their own* gardens. These participants expressed excitement in learning about the gardens and indicated that they planned to seek further information. One of the goals of this study was to provide useful information for the successful implementation of school gardens. By engaging participants in discussion about their perceptions of and experiences with the gardens, this project provided a catalyst for participants themselves to explore the gardens at the two schools.

Additional strengths of this study were that over 135 hours of participant observation and 22 face-to-face interviews were conducted. Both schools were also extremely cooperative with and supportive of the study procedures.

5.9 Conclusions

Results from this study support the notion that no single prescription exists to ensure successful school GBNE programming. The idea of "success" in fact, may itself be misguided. Because the outcomes of school garden programs are so varied and the experiences at any school depend on that school's unique characteristics, the definition of success likely varies from school to school. Existing literature indicates that school GBNE is a promising approach to improving nutrition-related outcomes among students. Additional personal, social and academic benefits have also been described. This study provided rich descriptions of numerous outcomes and experiences associated with school GBNE. The study is unique in that it offered a model through which school GBNE improves students' fruit and vegetable intake, and recommendations for the practical implementation of GBNE programs in schools.

APPENDICES

APPENDIX A: Initial Recruitment Letter

Dear School Administrator (will be replaced with actual name),

Hello, my name is Caroline Martin. I am a graduate student in Community Nutrition at Michigan State University. I would like to tell you about an opportunity for your school to participate in a research study on school gardens. The purpose of the study is to gain an understanding of how and why schools utilize gardens.

There are two components to the study. You may have already participated in the first component, an online survey of Michigan schools that was conducted in January of 2010. Your school has been recognized by garden-based educators throughout the mid-Michigan area as having a strong and unique garden program. Because of this recognition, we would like to include your school in the second component of the project - a case study to better understand the school garden experience.

The case study includes 1) staff interviews, 2) school garden observation, 3) student interviews, and 4) review of documents such as lesson plans and garden harvest records.

1. **Teacher and School Staff Interviews**
   The staff interviews will be conducted by an Institutional Review Board (IRB) trained researcher from MSU with key staff members. The purpose of the interviews will be to talk with school staff about their experiences and perceptions of the school garden. Each face-to-face interview will last about one hour, and will be scheduled individually at the convenience of the voluntary participant for a date between May and October, 2010. The interviews will likely be one-time interviews, with the possibility of a brief follow-up interview or phone call to be scheduled for further clarification if necessary. Consent will be obtained from all participants before the interviews. We would like to interview the following staff members:

   - One school administrator
   - One school food service director and one food service staff person
   - Three or more classroom or subject teachers that have actively used the garden in curricular or extracurricular education
   - Two or more classroom or subject area teachers that do not use the garden in curricular or extracurricular education
   - One or more school custodial or grounds keeping staff person
   - One or more additional garden-based nutrition educator (if applicable)

2. **School Garden Observations**
   The school garden observation component will be conducted during the fall of 2010. An IRB trained researcher from MSU will observe several garden-based sessions. The garden-based observation may occur in the actual garden or in a classroom session where the teaching is garden-based. The observer will not be involved with the students or teacher during the observation and will not record any identifiable private information from the students. Since no identifiable private information will be collected from the students and

since the observer will not come into contact with the students, only teacher consent will be obtained before the observation takes place. The observations will occur before the student interviews take place in order to ensure that the students don't recognize the observer and that the observer doesn't recognize the students.

3. **Student Interviews**
   The student interviews will be conducted by an IRB trained researcher from MSU during the fall of 2010, after the students have had an opportunity to be involved with the garden. Interviews will be conducted individually with 10 students who are involved with the school garden. We may ask a teacher or staff person to sit in on the first several minutes of the interview to help the student become comfortable with the interview situation. The students will be selected by their teacher for participation. The interviews will last no more than half an hour and will be conducted on an individual basis. The interviews will be conducted with fourth and fifth graders and the purpose of the interviews is to talk with the students about their school garden experiences. Student assent and parent consent will be obtained before students are interviewed.

4. **Review of School Garden Documents**
   For the document review, an IRB trained researcher from MSU will review documents such as lesson plans and garden harvest records for content.

If you are willing to have your school participate, I will provide you with a letter of support that will need to be signed and returned to me. To each staff person who participates in the interviews, we would like to offer a $15.00 gift card to Target, Meijer, or a teacher supply store.

If you have any questions about this study, please contact Caroline Martin by phone: (517) 355-8478 x 167; email: mart115@msu.edu; or via post mail: Department of Food Science & Human Nutrition, 338 Trout FSHN Building, Michigan State University, East Lansing, MI 48824.

Thank you so much for your time. We look forward to working with you!

Sincerely,

Caroline L. Martin
MS Candidate, Community Nutrition
Dept. of Food Science and Human Nutrition
Michigan State University
338 Trout FSHN Building
East Lansing, MI 48824

mart1152@msu.edu

517.355.8474 x 167 (office)
517.353.8963 (fax)

Katherine Alaimo, PhD
Associate Professor
Dept. of Food Science and Human Nutrition
215 G.M. Trout FSHN Building
Michigan State University
East Lansing, MI 48824-1224

alaimo@msu.edu

517-355-8474 x 138 (office)
517.353.8963 (fax)

APPENDIX B: Letters of Support - Janesville Elementary School

[redacted]

[redacted]

[redacted]

5/20/10

Katherine Alaimo, PhD
Department of Food Science & Human Nutrition
215 G.M. Trout FSHN Building
Michigan State University
East Lansing, MI 48824

Dear Dr. Alaimo and the MSU Institutional Review Board:

[redacted] Elementary School agrees to participate in the activities and evaluation of:

School Garden Nutrition Education (SGNE) Project
Principal Investigator: Dr. Katherine Alaimo, Associate Professor, Department of Food Science and Human Nutrition, Michigan State University
MSU IRB #: i033471, r031068

We understand that this project is being undertaken to learn about and improve garden-based nutrition education in schools, and are pleased to partnering with you on this project.

Our school agrees to participate in the following activities:

1. Teacher and School Staff Interviews

   The staff interviews will be conducted by an Institutional Review Board (IRB) trained researcher from MSU with key staff members, including teachers, food service staff, grounds and custodial staff, and administrators. The purpose of the interviews will be to talk with the staff about their experiences and perceptions of the school garden. Each face-to-face interview will last about one hour, and will be scheduled individually at the convenience of the voluntary participant for a date between May and September, 2010. The interviews will likely be on-time interviews, with the possibility of a brief follow-up interview or phone call to be scheduled for further clarification if necessary. Consent will be obtained from all participants before the interviews. We would like to interview staff members who hold each of the following roles:

- One school administrator
- One school food service director and one food service staff person
- Three or more classroom or subject teachers that have actively used the garden in curricular or extracurricular education
- One or more school custodial or grounds keeping staff person
- One or more additional garden-based nutrition educator (if applicable)

2. School Garden Observations

The school garden observation component will be conducted during the fall of 2010. An IRB trained researcher from MSU will observe several garden-based sessions. The garden-based observation may occur in the actual garden or in a classroom session where the teaching is garden-based. The observer will not be involved with the students or teacher during the observation and will not record any identifiable private information from the students. Since no identifiable private information will be collected from the students and since the observer will not come into contact with the students, only teacher consent will be obtained before the observation takes place. The observations will occur before the student interviews take place in order to ensure that the students don't recognize the observer and that the observer doesn't recognize the students.

3. Student Interviews

The student interviews will be conducted by an IRB trained researcher from MSU during the fall of 2010, after the students have had an opportunity to be involved with the garden. Interviews will be conducted individually with 10 students who are involved with the school garden. We may ask a teacher or staff person to sit in on the first several minutes of the interview to help the student become comfortable with the interview situation. The students will be selected by their teacher for participation. The interviews will last no more than half an hour and will be conducted on an individual basis. The interviews will be conducted with fourth and fifth graders and the purpose of the interviews is to talk with the students about their school garden experiences. Student assent and parent consent will be obtained before students are interviewed.

4. Review of School Garden Documents

For the document review, an IRB trained researcher from MSU will review documents such as lesson plans and garden harvest records for content.

We are pleased to participate in this study.

Sincerely

APPENDIX C: Letters of Support (cont.) - Gilsonville Elementary School

August 2, 2010

Katherine Alaimo, PhD
Department of Food Science & Human Nutrition
215 G.M. Trout FSHN Building
Michigan State University
East Lansing, MI 48824

Dear Dr. Alaimo and the MSU Institutional Review Board:

[redacted] Elementary School agrees to participate in the activities and evaluation of:

School Garden Nutrition Education (SGNE) Project
Principal Investigator: Dr. Katherine Alaimo, Associate Professor, Department of Food Science and Human Nutrition, Michigan State University
MSU IRB #: i033471, r031068

We understand that this project is being undertaken to learn about and improve garden-based nutrition education in schools, and are pleased to partnering with you on this project.

Our school agrees to participate in the following activities:

5. Teacher and School Staff Interviews

   The staff interviews will be conducted by an Institutional Review Board (IRB) trained researcher from MSU with key staff members, including teachers, food service staff, grounds and custodial staff, and administrators. The purpose of the interviews will be to talk with the staff about their experiences and perceptions of the school garden. Each face-to-face interview will last about one hour, and will be scheduled individually at the convenience of the voluntary participant for a date between May and September, 2010. The interviews will likely be on-time interviews, with the possibility of a brief follow-up interview or phone call to be scheduled for further clarification if necessary. Consent will be obtained from all participants before the interviews. We would like to interview staff members who hold each of the following roles:

- One school administrator
- One school food service director and one food service staff person
- Three or more classroom or subject teachers that have actively used the garden in curricular or extracurricular education
- One or more school custodial or grounds keeping staff person
- One or more additional garden-based nutrition educator (if applicable)

6. School Garden Observations

The school garden observation component will be conducted during the fall of 2010. An IRB trained researcher from MSU will observe several garden-based sessions. The garden-based observation may occur in the actual garden or in a classroom session where the teaching is garden-based. The observer will not be involved with the students or teacher during the observation and will not record any identifiable private information from the students. Since no identifiable private information will be collected from the students and since the observer will not come into contact with the students, only teacher consent will be obtained before the observation takes place. The observations will occur before the student interviews take place in order to ensure that the students don't recognize the observer and that the observer doesn't recognize the students.

7. Student Interviews

The student interviews will be conducted by an IRB trained researcher from MSU during the fall of 2010, after the students have had an opportunity to be involved with the garden. Interviews will be conducted individually with 10 students who are involved with the school garden. We may ask a teacher or staff person to sit in on the first several minutes of the interview to help the student become comfortable with the interview situation. The students will be selected by their teacher for participation. The interviews will last no more than half an hour and will be conducted on an individual basis. The interviews will be conducted with fourth and fifth graders and the purpose of the interviews is to talk with the students about their school garden experiences. Student assent and parent consent will be obtained before students are interviewed.

8. Review of School Garden Documents

For the document review, an IRB trained researcher from MSU will review documents such as lesson plans and garden harvest records for content.

We are pleased to participate in this study.

Sincerely

APPENDIX D: Interview Guides – Administrator

(Text in italics are the questions that will be asked of the interviewees. Text in bold will be the direct questions – text not in bold will be probe questions. Text not in italics are headings.)

1. What are administrator experiences and perceptions of the school garden?

A) I'd like to talk with you about your school's garden. Can you tell me about the garden?

Topics to cover:

- ☐ *What do you think about your school's garden? What is your general impression or opinion of the garden?*

- ☐ *How long has your school had a garden?*
  - *i. If first year: Why did your school establish the garden?*
  - *ii. Multiple years: Why did your school establish the garden? Why has your school decided to continue to maintain the garden?*

- ☐ *How was the decision made to start the garden?*

- ☐ *How is the garden used at your school?*
  - *i. Is it used for academic instruction? If so, what subjects are taught?*
  - *ii. Is it used for professional development?*
  - *iii. Is it used for community building?*
  - *iv. Is it used for food production?*

- ☐ *Do you think that using the garden is effective in teaching curricular subjects such as math or language arts? Why or why not?*

- ☐ *Is the garden used for Nutrition Education? Do you think that the garden is an effective tool for teaching Nutrition? Why or why not?*

- ☐ *Do you think that using the garden as a teaching tool has advantages over other methods of student engagement? Describe the advantage(s) you have experienced. Is this (advantage) a reason that you support the garden?*

- ☐ *Does using the garden have limitations compared to other methods of student engagement? What have you experienced as limitations of using the garden?*

- ☐ *Overall do you support the garden at your school? If so, why? If not, why not? How do you communicate your support or lack of support?*

B) I'd like to learn a little more about your experience of and involvement with the garden. Are you involved with the garden? If so, how?

Have you interacted with students in the garden? Please describe your experience.

Topics to cover:

- ☐ *Please describe your role at the school and with the school garden.*
- ☐ *Have you seen students respond to the garden being used as a teaching tool? If so, please describe a scenario that illustrates a positive, negative, or neutral student response.*
- ☐ *Has the garden had any noticeable impacts on the students or on the school as a whole? Please provide an example.*
- ☐ *Has the garden ever caused any problems or conflict at your school?*

2. Funding and grants. Guidelines and standards to be met.

C) So, now I'd like to talk about funding and support for the garden. Can you tell me about how the garden is financially supported?

If the garden is funded externally, for example, by a grant, are there requirements that must be met for this funding? If so, what are these goals and how do you measure and report them?

Topics to cover:

- ☐ *How is the garden at your school financially supported?*
- ☐ *Do you have any grants or other funding sources that provide guidelines or objectives that need to be followed or achieved through the garden programming?*
  - *i. If yes, what is/are the grant(s) that you receive and what are their requirements?*
- ☐ *Are you able to achieve the objectives / standards required for funding purposes?*
- ☐ *How do you measure your compliance with or progress toward the standards or objectives set forth by your grantor(s)?*
- ☐ *Do you feel that you have adequate resources to measure these outcomes? Why or why not?*
- ☐ *Do you feel that these standards impact the quality of garden-based nutrition education delivered through the garden - either positively or negatively? How?*

3. Policy.

D. Now that we've covered funding, I'd like to talk with you about policies at your school that affect the school garden. Can you describe any policies or rules that your school has that affect the garden?

Topics to cover:

- ☐ *Does your school have a local wellness policy? If so, can you tell me about the purpose of the policy?*
- ☐ *Are there any rules at your school regarding foods or beverages that are considered unhealthy? Can you give an example?*
- ☐ *Are there any rules at your school regarding nutrition education? If so, can you give an example?*
- ☐ *Does your school try to promote physical activity among students? If so, how?*
- ☐ *How are decisions about health and wellness made at your school?*
- ☐ *Do any of these rules impact the use of the school garden? If so, how?*
- ☐ *Is nutrition education at your school affected by school policy? How?*
- ☐ *In your opinion, do you think that policies should be established (both school wide or even nationally) to promote garden based nutrition education? If so, please describe what kinds of policies you think should be established.*
- ☐ *Do you think that the local wellness policy is effective? Why or why not?*
- ☐ *Are there ways in which the policy can be improved? If so, how?*

4. School Support

E. So now I have a few questions about staff involvement with the garden at your school. How would you say that the school, as a while, embraces the garden?

Also, what do you think staff at the school think about the garden?

I'm also interested in how parents and the community receive the garden. Are parents and community members involved with or interested in the garden, if so, how?

Topics to cover:

- ☐ *How many teachers at your school use the garden?*

- ☐ *How difficult or easy is it for teachers to get involved with the garden?*
- ☐ *What kind of support is there for a teacher who wants to use the garden but may lack confidence in their gardening abilities?*
- ☐ *Are there any barriers that teachers may experience in using the garden?*
- ☐ *How do you think teachers who are not involved with the garden view the garden?*
- ☐ *Are parents or community members involved with the garden? If so, in what way are they involved? If not, what are the barriers to their involvement?*
- ☐ *Do you think that the garden has an impact on the work of school staff other than teachers? How do you think that those personnel view the garden?*
- ☐ *Do you think that the garden is a program that will be able to continue year after year? Why or why not?*

APPENDIX D: Interview Guides (cont.) - Food Service Staff

(Text in italics are the questions that will be asked of the interviewees. Text in bold will be the direct questions – text not in bold will be probe questions. Text not in italics are headings.)

2. What are staff experiences and perceptions of the school garden?

A. I'd like to learn a little bit about the garden at your school. Specifically, I'm interested in your experiences with the garden. Can you tell me if and how you are involved with the garden and how the garden fits into your responsibilities at the school?

Also, what do you think about your school's garden? What is your general impression or opinion?

Topics to cover:

- ☐ *Please describe your role at the school and your involvement with the school garden?*
- ☐ *How much interaction do you have with students on a daily basis?*
- ☐ *How much interaction do you have with other staff members on a daily basis?*
- ☐ *What can you tell me about the garden here at your school (as you know it)?*
- ☐ *How is the garden used at the school? What is it's purpose?*
- ☐ *How long has your school had a garden?*
    - i. *If first year: Why did your school establish the garden?*
    - ii. *Multiple years: Why did your school establish the garden? Why has your school decided to continue to maintain the garden?*

B. I'd like to talk a little bit more about the garden. Can you tell me what you think about the garden with regards to how the students respond? How do the students respond to the garden? Can you elaborate on this?

Topics to cover:

- ☐ *How much interest do you think the students have in the school garden? Why do you say this?*
- ☐ *Do you think that having a school garden provides any benefits to students? To the school as a whole? If so, what benefits, and why?*

C. I'm wondering what the relationship is like between the garden program and food service. Can you please describe to me any interaction between the garden and food service. What do you think of this relationship?

Topics to cover:

- ☐ *Is produce from the garden ever used by food service? If so, how often does this occur? Please describe how this food is used?*
- ☐ *Do you think that students would like to eat produce from the garden? Why or why not?*
- ☐ *Have you received any support or encouragement to incorporate the garden into food service? If so, please describe. If not, what type of support would be helpful?*
- ☐ *Have you been discouraged from incorporating the garden into food service? If so, please describe.*
- ☐ *How willing are you to incorporate foods from the garden into food service?*
- ☐ *What would/did motivate you to incorporate food from the garden into the food service program?*
- ☐ *What would you envision as an ideal relationship between the school garden and foods service?*
- ☐ *What obstacles prevent that ideal relationship from becoming a reality?*
- ☐ *Do teachers ever serve food from the garden to their students in class? What do you think about that?*
- ☐ *Has the garden had any noticeable impacts on the students or on the school as a whole?*
- ☐ *Has the garden ever caused any problems or conflict at your school?*
- ☐ *Overall do you support the garden at your school? If so, why? If not, why not?*

2. Policy.

D. Now that we've covered the basics, I'd like to talk with you about policies at your school that affect the school garden. Can you describe any policies or rules that your school has that affect the garden?

Topics to cover:

- ☐ *Does your school have a local wellness policy? If so, can you tell me about the purpose of the policy?*
- ☐ *Are there any rules at your school regarding foods or beverages that are considered unhealthy? Can you give an example?*
- ☐ *Does your school try to promote physical activity among students? If so, how?*
- ☐ *How are decisions about health and wellness made at your school?*
- ☐ *How do these rules impact food service?*
- ☐ *Do any of these rules impact the use of the school garden in any way? If so, how?*

E. Do you think that wellness policy is effective? Why or why not? Are there ways in which the policy can be improved? If so, how?

3. School Support

F. So now I have a few questions about staff involvement with the garden at your school. How would you say that the school, as a whole, embraces the garden?

Also, how do you think staff at the school perceive the garden?

And finally, do you feel that the garden affects your work? If so, please describe.

Topics to cover:

- ☐ *How do you think that the school, as a whole, embraces the garden?*
- ☐ *Do you think that the garden has an impact on your work?*
- ☐ *How do you think that other food service personnel view the garden? Why do you say this?*
- ☐ *How do you think that the school administrators view the garden? Why makes you believe this?*
- ☐ *Do you think that the garden is a program that will be easy to continue year after year? Why or why not?*

APPENDIX D: Interview Guides (cont.) - Custodial or Grounds Staff

(Text in italics are the questions that will be asked of the interviewees. Text in bold will be the direct questions – text not in bold will be probe questions. Text not in italics are headings.)

3. What are staff experiences and perceptions of the school garden?

D. I'd like to learn a little bit about the garden at your school. Specifically, I'm interested in your experiences with the garden. Can you tell me if and how you are involved with the garden and how the garden fits into your responsibilities at the school?

Also, what do you think about your school's garden? What is your general impression or opinion?

Topics to cover:

- ☐ *Please describe your role at the school and your involvement with the school garden?*
- ☐ *How much interaction do you have with students on a daily basis?*
- ☐ *How much interaction do you have with other staff members on a daily basis?*
- ☐ *What can you tell me about the garden here at your school (as you know it)?*
- ☐ *How long has your school had a garden?*
    - i. *If first year: Why did your school establish the garden?*
    - ii. *Multiple years: Why did your school establish the garden? Why has your school decided to continue to maintain the garden?*

E. I'd like to talk a little bit more about the garden. Can you tell me what you think about the garden with regards to how the students respond? How do the students respond to the garden? Can you elaborate on this?

Topics to cover:

- ☐ *How much interest do you think the students have in the school garden? Why do you say this?*

☐ *Do you think that having a school garden provides any benefits to students? To the school as a whole? If so, what benefits, and why?*

☐ *How is the garden used at your school? Is it used for academic instruction? Is it used to teach Nutrition? Are there other purposes or uses for the garden?*

☐ *Has the garden ever caused any problems or conflict at your school?*

4. Policy.

a. Now that we've covered the basics, I'd like to talk with you about policies at your school that affect the school garden. Can you describe any policies or rules that your school has that affect the garden?

Topics to cover:

☐ *Does your school have a local wellness policy? If so, can you tell me about the purpose of the policy?*

☐ *Are there any rules at your school regarding foods or beverages that are considered unhealthy? Can you give an example?*

☐ *Does your school try to promote physical activity among students? If so, how?*

☐ *How are decisions about health and wellness made at your school?*

☐ *How do these rules impact you?*

☐ *Do any of these rules impact the use of the school garden in any way? If so, how?*

b. Do you think that wellness policy is effective? Why or why not? Are there ways in which the policy can be improved? If so, how?

5. School Support

G. So now I have a few questions about staff involvement with the garden at your school. How would you say that the school, as a whole, embraces the garden?

Also, how do you think staff at the school perceive the garden?

And finally, do you feel that the garden affects your work? If so, please describe.

Topics to cover:

- ☐ *How do you think that the school, as a whole, embraces the garden?*
- ☐ *Do you think that the garden has an impact on your work?*
- ☐ *How do you think that other school staff view the garden? Why do you say this?*
- ☐ *How do you think that the school administrators view the garden? Why makes you believe this?*
- ☐ *Do you think that the garden is a program that will be easy to continue year after year? Why or why not?*

APPENDIX D: Interview Guides (cont.) - Teachers – Engaged with Garden

(Text in italics are the questions that will be asked of the interviewees. Text in bold will be the direct questions – text not in bold will be probe questions. Text not in italics are headings.)

1. Garden in the classroom

D) I'd like to talk with you about your school's garden. Can you tell me about the garden? Also can you tell me how you are involved with the garden?

Topics to cover:

- ☐ *Please describe your role at the school and your involvement with the school garden?*
- ☐ *What do you think about your school's garden? What is your general impression or your general opinion?*
- ☐ *Do you use the garden as a teaching tool? If so, what subject(s) do you teach using the garden? Why did you decide to teach that/those subjects using the garden?*
- ☐ *How long have you used this garden as a teaching tool?*
  - i. *If first year: Why did you decide to start using a garden with your students?*
  - ii. *Multiple years: Why did you decide to start using a garden with your students? Why did you decide to continue to incorporate the garden into your classroom?*
- ☐ *How many hours a week and how often do you use the garden?*
  - i. *Do you use the integrated garden-based learning into your lessons equally throughout the year, or seasonally?*
  - ii. *Can you describe how you used the garden differently depending on the seasons?*
  - iii. *During the fall, how many hours per week, on average, do you use the garden as a teaching tool? What about the winter and spring? What about summer?*
  - iv. *How do you determine how frequently you use the garden for academic instruction?*

E) I'd like to know a little bit more about how you use the garden and how you incorporate the garden into your classroom lessons and activities. Can you describe how you typically use the garden and how you design your garden-based lessons?

Topics to cover:

- ☐ *How do you design your lesson plans that incorporate the garden?*
- ☐ *When you plan lessons that incorporate the garden, do you start with what's going on in the garden and try to match that to a teaching objective, or do you start with a teaching objective and try to find something in the garden that ties in?*

- ☐ *Have you received any support or encouragement to incorporate the garden into your teaching? If so, please describe. If not, what type of support would you like to receive?*

- ☐ *Have you been discouraged from incorporating the garden into your teaching? If so, please describe.*

- ☐ *Can you give me an example of a lesson that incorporates the garden?*

- ☐ *Has the garden ever caused any problems or conflict at your school? If so, please describe.*

F) So now that we've talked about how you work with the garden, I'd like to talk about the students. Can you describe how the students experience the garden – for example, are they engaged, interested, do they respond positively or negatively?

Topics to cover:

- ☐ *Have you seen students respond to the garden as a teaching tool? If so, can you describe their response.*
  - *i. Would you describe their response as positive, neutral, or negative?*
    - *a. Are the students engaged, interested?*
    - *b. Do the students talk about the garden in classroom discussions?*
    - *c. Do students have an aversion to getting dirty or going outside? If so, how do they express this?*
  - *ii. Describe a scenario that illustrates a student's response to the garden.*

G) Now I have a few very general questions for you:

What do you envision as the ideal school garden program for your school?

What obstacles, if any, prevent that ideal program from becoming a reality at your school?

2. Garden-based Nutrition Education

H) Now I'd like us to shift gears a little bit. I'm interested in learning about Nutrition Education specifically within your classroom. Is the garden used as a teaching tool for nutrition education or physical activity? Can you describe the process?

Topics to cover:

- ☐ *Do you teach Nutrition using the garden?*
- ☐ *Do you ever cook with or eat fruits or veggies from the garden with the students? Describe a scenario in which you cooked with or ate fruits or vegetables from the garden with students.*
- ☐ *Do you use the garden to promote physical activity? Can you give an example?*
- ☐ *Do you ever use the garden to discuss foods or food groups? Can you give an example of how you use the garden to discuss foods or food groups?*
- ☐ *Do you use the garden to discuss the benefits of fruits and vegetables? Can you give an example?*
- ☐ *Do you use the garden to discuss the benefits of whole grains? Can you give an example?*
- ☐ *Do you use the garden to discuss the benefits of low fat dairy? Can you give an example?*
- ☐ *Do you use the garden to discuss the nutritional value of foods? Can you give an example?*
- ☐ *Do you use the garden to initiate discussions about health? Can you give an example?*

I) I have a few more questions about how and why you use the garden to teach nutrition. Basically I'd like to know why you have decided to use the garden to teach nutrition.

How do you structure your nutrition lessons- are they free standing or part of a curricular lesson (such as a science lesson)? What kind of planning resources are available to you?

Also, can you describe any advantages and or limitations to using the garden as a tool teach nutrition.

Topics to cover:

- ☐ *Why do you use the garden to teach nutrition?*

☐ *Do you think that using the garden as a teaching tool for nutrition education has advantages over other methods of nutrition education?*
   i. *Describe the advantage(s) you have experienced.*
   ii. *Is this (advantage) a reason that you use the garden?*

☐ *Does using the garden for nutrition education have limitations compared to other methods of nutrition education?*
   i. What have you experienced as limitations of using the garden as a teaching tool?

☐ *Do you integrate nutrition education into your curricular lessons or do you teach nutrition separately? Why do you choose to integrate/teach separately?*
   i. If nutrition is integrated into curricular lessons, how is it integrated?

☐ *Do you think that using a garden as a teaching tool for curricular subjects such as science or social studies has advantages over other methods?*
   i. If so describe the advantage(s) you have experienced.
   ii. Is this (advantage) a reason that you use the garden?

☐ *Does using the garden as a teaching tool for curricular subjects have limitations compared to other methods?*
   i. What have you experienced as limitations of using the garden as a teaching tool?

☐ *What resources do you use for garden-based nutrition education lesson plan development?*
   i. How did you find these resources?

☐ *Do you feel that you have access to the resources that you need or do you feel that you need additional resources when planning nutrition ed. lessons that use the garden?*
   i. (If answered "needs additional resources") *So, you feel that you need additional resources; why do you feel this way? What type of resource would be helpful to you?*

3. Funding and grants. Guidelines and standards to be met.

G) So, now I'd like to talk about funding and support for the garden. Can you tell me about how the garden is financially supported?

If the garden is funded externally, for example, by a grant, are there requirements that must be met for this funding? If so, what are these goals and how do you measure and report them?

Topics to cover:

- ☐ *How is the garden at your school financially supported?*

- ☐ *Do you have any grants or other funding sources that provide guidelines or objectives that need to be followed or achieved through the garden programming?*
    - *i. If yes, what is/are the grant(s) that you receive and what are their requirements?*

- ☐ *Are you able to achieve the objectives / standards required for funding purposes?*

- ☐ *How do you measure your compliance with or progress toward the standards or objectives set forth by your grantor(s)?*

- ☐ *Do you feel that you have adequate resources to measure these outcomes? Why or why not?*

- ☐ *Do you feel that these standards impact the quality of garden-based nutrition education delivered through the garden - either positively or negatively? How?*

4. Policy

H) I'd like to talk with you about policies at your school that affect the school garden. Can you describe any policies or rules that your school has that affect the garden?

Topics to cover:

- ☐ *Does your school have a local wellness policy? If so, can you tell me about the purpose of the policy?*

- ☐ *Are there any rules at your school regarding foods or beverages that are considered unhealthy? Can you give an example?*

- ☐ *Are there rules at your school regarding nut. ed.? Can you give an example?*

- ☐ *Does your school try to promote physical activity among students? If so, how?*

- ☐ *How are decisions about health and wellness made at your school?*

- ☐ *Do any of these rules impact the use of the school garden? If so, how?*

- ☐ *Is nutrition education at your school affected by school policy? How?*

- ☐ *In your opinion, do you think that policies should be established (school wide or even nationally) to promote garden based nutrition education? If so, please describe what kinds of policies you think should be established. If not, why not?*

☐ *Do you think that the local wellness policy is effective? Why or why not?*

☐ *Are there ways in which the policy can be improved? If so, how?*

5. School Support

I) So now I have a few questions about staff involvement with the garden at your school. How would you say that the school, as a while, embraces the garden?

Also, what do you think staff at the school think about the garden? (i.e. teachers who don't use the garden, food service, administration).

I'm also interested in how parents and the community receive the garden. Are parents and community members involved with or interested in the garden, if so, how?

Topics to cover:

☐ *How many teachers at your school use the garden?*

☐ *How difficult or easy is it for teachers to get involved with the garden?*

☐ *What kind of support is there for a teacher who wants to use the garden but may lack confidence in their gardening abilities?*

☐ *Are there any barriers that teachers may experience in using the garden?*

☐ *How do you think teachers not involved with the garden view the garden?*

☐ *What do the administrators at your school think about the garden? Do they support the program? If so, please provide an example. If not, please describe.*

☐ *Are parents or community members involved with the garden? If so, in what way are they involved? If not, what are the barriers to their involvement?*

☐ *Do you think that the garden has an impact on the work of school staff other than teachers? How do you think that those personnel view the garden?*

☐ *Do you think that the garden is a program that will be able to continue year after year? Why or why not?*

APPENDIX D: Interview Guides (cont.) - Teachers – Not Engaged with Garden

Interview Guide - Teachers (don't use garden)

(Text in italics are the questions that will be asked of the interviewees. Text in bold will be the direct questions – text not in bold will be probe questions. Text not in italics are headings.)

4. What are staff experiences and perceptions of the school garden?

F. I'd like to learn a little bit about the garden at your school. Specifically, I'm interested in your experiences with and thoughts about the garden. Can you tell me what you know about your school's garden?

Also, what do you think about your school's garden? What is your general impression or opinion?

Topics to cover:

- ☐ *Please describe your role at the school and your involvement with the school garden?*
- ☐ *How long have you been teaching at this school and what do you teach?*
- ☐ *What can you tell me about the garden here at your school (as you know it)?*
- ☐ *Why do you think your school has a garden? What is it's purpose?*
- ☐ *Do you have any interest in using the school garden in any way? If so, how would you like to use the garden and why? If not, why?*
- ☐ *Does the school garden affect you or your students?*

G. I'd like to talk a little bit more about the garden. Can you tell me what you think about the garden with regards to how the students respond? How do the students respond to the garden? Can you elaborate on this?

Topics to cover:

- ☐ *How much interest do you think the students have in the school garden? Why do you say this?*
- ☐ *Do you think that having a school garden provides any benefits to students who use it? To the school as a whole? If so, what benefits, and why?*
- ☐ *How is the garden used at your school? Is it used for academic instruction? Is it used to teach Nutrition? Are there other purposes or uses for the garden?*

- ☐ *Do you think that a garden can be used to teach curricular subjects such as math, science, or language arts? Please explain why you think this way?*
- ☐ *Do you think that a garden can be used to teach nutrition? Why or why not?*
- ☐ *Do you think that using a garden to teach nutrition or even curricular subjects has any advantages or limitations when compared to other teaching methods?*
- ☐ *Has the garden ever caused any problems or conflict at your school?*

2. Policy

C. I'd like to talk with you about policies at your school that affect the school garden. Can you describe any policies or rules that your school has that deal with health and wellness?

Topics to cover:

- ☐ *Does your school have a local wellness policy? If so, can you tell me about the purpose of the policy?*
- ☐ *Are there any rules at your school regarding foods or beverages that are considered unhealthy? Can you give an example?*
- ☐ *Are there rules at your school regarding nut. ed.? Can you give an example?*
- ☐ *Does your school try to promote physical activity among students? If so, how?*
- ☐ *How are decisions about health and wellness made at your school?*
- ☐ *Do any of these rules impact the use of the school garden? If so, how?*
- ☐ *Is nutrition education at your school affected by school policy? How?*
- ☐ *In your opinion, do you think that policies should be established (school wide or even nationally) to promote garden based nutrition education? If so, please describe what kinds of policies you think should be established. If not, why not?*
- ☐ *Do you think that the local wellness policy is effective? Why or why not?*
- ☐ *Are there ways in which the policy can be improved? If so, how?*

3. School Support

C. So now I have a few questions about staff involvement with the garden at your school. How would you say that the school, as a while, embraces the garden?

Also, what do you think staff at the school think about the garden? (i.e. teachers who don't use the garden, teachers who use the garden, food service, administration).

Topics to cover:

- ☐ *How many teachers at your school use the garden?*
- ☐ *How difficult or easy is it for teachers to get involved with the garden?*
- ☐ *Why don't you use the garden?*
- ☐ *Why do you think that some of the teachers use the garden Why do you say this?*
- ☐ *What kind of support is there for a teacher who wants to use the garden but may lack confidence in their gardening abilities?*
- ☐ *Are there any barriers that teachers may experience in using the garden?*
- ☐ *What do the administrators at your school think about the garden? Do they support the program? If so, please provide an example. If not, please describe.*
- ☐ *Are parents or community members involved with the garden? If so, in what way are they involved? If not, what are the barriers to their involvement?*
- ☐ *Do you think that the garden has an impact on the work of school staff other than teachers? How do you think that those personnel view the garden?*

APPENDIX E: Consent Forms

SCHOOL GARDEN NUTRITION EDUCATION
MY GARDEN PROJECT
MICHIGAN STATE UNIVERSITY
INTERVIEW CONSENT FORM

We would like to invite you to participate in a research study that aims to understand how and why schools utilize food gardens.

Participating in the MyGarden research study will involve a 1 hour face-to-face interview that will take place at your school.

You should know that:

- ✓ We are asking for your involvement in this research study for a one hour face-to-face interview. A researcher from Michigan State University will come to your school and meet with you to ask you questions.

- ✓ The interview will be digitally voice recorded unless you request otherwise.

- ✓ If necessary, the interviewer may contact you by phone one additional time in case they have any follow-up questions.

- ✓ Benefit to you includes the opportunity to assist in the understanding of barriers and facilitators to school gardening. In addition, you will receive a $15.00 girt card to Meijer, Target, or a teacher supply store.

- ✓ Your participation is confidential to the maximum extent allowable by law. A code number will be used to identify your interview. Your name and your code number will be kept on a confidential list in locked facilities at the Michigan State University. This list will be destroyed after all information is collected in the study. No one outside the MSU research team and the MSU Institutional Review Board will know that you participated in the study or how you answered the questions.

- ✓ Your contact information will not be given to anyone outside of the research team or be used for any purpose other than contacting you about aspects of this study.

- ✓ The information you provide may be used to develop a report, publications, and presentations at meetings or conferences.

- ✓ There are no known risks to you associated with being involved in this study.

This consent form was approved by the Biomedical and Health Institutional Review Board (BIRB) at Michigan State University. Approved 7/28/10 – valid through 7/27/11 This version supersedes all previous versions. IRB #09-582.

- ✓ Your participation is voluntary. You may refuse to participate in certain procedures, answer certain questions, or discontinue your participation at any time without penalty.

- ✓ If you have any concerns or questions about this research study, such as scientific issues, how to do any part of it, or to report an injury, please contact Dr. Katherine Alaimo, Associate Professor, MSU at (517) 355-8474 x138. If you have questions or concerns about your role and rights as a research participant, would like to obtain information or offer input, or would like to register a complaint about this study, you may contact, anonymously if you wish, the Michigan State University's Human Research Protection Program at 517-355-2180, Fax 517-432-4503, or e-mail irb@msu.edu or regular mail at 207 Olds Hall, MSU, East Lansing, MI 48824.

Knowing all this, I agree to participate in the School Garden Nutrition Education - MyGarden study.

_____
Printed Name

_____ _____
Participant Signature Date

_____
Mailing Address

_____ _____ _____ _____
City State Zip Phone #

_____
Email address

☐ **Yes, I agree** to have my interviews for this study audio recorded.

☐ **No, I do not agree** to have my interviews for this study audio recorded.

_____
Signature

This consent form was approved by the Biomedical and Health Institutional Review Board (BIRB) at Michigan State University. Approved 7/28/10 – valid through 7/27/11 This version supersedes all previous versions. IRB #09-582.

APPENDIX E: Consent Forms (cont.)

SCHOOL GARDEN NUTRITION EDUCATION
MY GARDEN PROJECT
MICHIGAN STATE UNIVERSITY
OBSERVATION CONSENT FORM

We would like to invite you to participate in a research study that aims to understand how and why schools utilize food gardens.

Participating in the MyGarden research study will involve allowing a researcher from MSU to participate with and observe your classrooms' garden-based activities. Researcher participation can include the researcher assisting in the logistics and delivery of garden-based lessons.

You should know that:

- ✓ We are asking for your involvement in this research study by allowing a researcher from Michigan State University to come to your class to participate with and observe garden-based activities.

- ✓ The researcher will take field notes on the garden-based experience once the class has ended.

- ✓ A benefit to you includes the opportunity to assist in the understanding of barriers and facilitators to school gardening.

- ✓ Your participation is confidential to the maximum extent allowable by law. A code number will be used to identify you in the researcher's field notes. Your name and your code number will be kept on a confidential list in locked facilities at the Michigan State University. This list will be destroyed after all information is collected in the study. No one outside the MSU research team and the MSU Institutional Review Board will know that you participated in the study or how you answered the questions.

- ✓ Your contact information will not be given to anyone outside of the research team or be used for any purpose other than contacting you about aspects of this study.

- ✓ The information you provide may be used to develop a report, publications, and presentations at meetings or conferences.

- ✓ There are no known risks to you associated with being involved in this study.

- ✓ Your participation is voluntary. You may refuse to participate in certain procedures, answer certain questions, or discontinue your participation at any time without penalty.

This consent form was approved by the Biomedical and Health Institutional Review Board (BIRB) at Michigan State University. Approved 8/31/10 – valid through 7/27/11. This version supersedes all previous versions. IRB # 09-582.

If you have concerns or questions about this study, such as scientific issues, how to do any part of it, or to report an injury, please contact the researcher Dr. Katherine Alaimo, Associate Professor, MSU, at (517) 355-8474 x138, 302C G.M. Trout FSHN Bldg, Michigan State University, East Lansing, MI 48824-1224 alaimo@msu.edu.

If you have questions or concerns about your role and rights as a research participant, would like to obtain information or offer input, or would like to register a complaint about this study, you may contact, anonymously if you wish, the Michigan State University's Human Research Protection Program at 517-355-2180, Fax 517-432-4503, or e-mail irb@msu.edu or regular mail at 207 Olds Hall, MSU, East Lansing, MI 48824.

I agree to participate in the School Garden Nutrition Education - MyGarden study.

_____
Printed Name

_____ _____
Participant Signature Date

_____
Mailing Address

_____ _____ _____ _____
City State Zip Phone #

_____
Email address

Thank you!

This consent form was approved by the Biomedical and Health Institutional Review Board (BIRB) at Michigan State University. Approved 8/31/10 – valid through 7/27/11. This version supersedes all previous versions. IRB # 09-582.

APPENDIX E: Consent Forms (cont.)

SCHOOL GARDEN NUTRITION EDUCATION
MY GARDEN PROJECT
MICHIGAN STATE UNIVERSITY
PARENT/CAREGIVER CONSENT FORM

Dear Parent/Caregiver,

Your student's school is taking part in the **School Garden Nutrition Education - MyGarden Project** with Michigan State University. This project will help us to better understand how school gardens are used and experienced at Michigan schools.

As part of this research project, your child will be invited to discuss his or her experience with the garden at their school. A researcher from Michigan State University will participate in the garden activities and may interact with your child, asking questions about their experience with the garden.

Participation of your child in this study involves:

- ✓ Classroom and garden observations: A trained MSU researcher will observe your child's class or after school group during the months of September, October and November. The researcher will participate in garden-based activities and will assist your child's teacher in leading garden-based lessons. While participating in the garden-based lessons, the researcher will also make observations of the class. Observations will not interrupt classroom activities. At any time, you or your child can tell the teacher that he or she does not wish to be observed and the researcher will not record any observations of your child. If you allow your child to be observed, the researcher will record observations in the form of field notes, which will be written after the class session.

- ✓ Collection of work/activities: The same MSU researcher will collect work that your child has completed as part of the school garden program. This work may include drawings or journal entries. The work that will be collected is only work that is related to their participation and experience with the school garden.

You should know:

- ✓ We do not expect any risk to your child, but there is a chance your child might feel uncomfortable discussing their experience with the garden.

- ✓ Your child's participation is voluntary. Your child may refuse to participate in certain procedures, answer certain questions, or discontinue their participation at any time without penalty. This will not affect treatment they receive and will not affect their grades or evaluation.

This consent form was approved by the Biomedical and Health Institutional Review Board (BIRB) at Michigan State University. Approved 8/31/10 – valid through 7/27/11. This version supersedes all previous versions. IRB # 09-582.

- ✓ Your child will not directly benefit from participating in this project; however, your child might find the learning and discussions interesting and fun.

- ✓ Participation in this research project will not take your child away from any instructional time and participation will not affect your child's grades.

- ✓ Notes will be taken by the researcher after interacting with students.

- ✓ Your child will be asked to provide either verbal assent or written assent for participation in the project in addition to your written consent.

- ✓ The information your child and other children at the school share may be used to write a project report, materials to assist schools, and other types of publications and presentations designed to improve school health *only*, and will not include your child's name.

- ✓ Information collected about your child is strictly confidential to the maximum extent allowable by law. Your child's name will be removed and replaced by a code number. The list of names and code numbers will be kept in a locked office and will be destroyed at the end of the study.

- ✓ Project results will be shared with researchers at Michigan State University, the MSU Institutional Review Board, and your child's school. Identifying information will not be included in the results.

Contact information:

If you have concerns or questions about this study, such as scientific issues, how to do any part of it, or to report an injury, please contact the researcher Dr. Katherine Alaimo, Associate Professor, MSU, at (517) 355-8474 x138, 302C G.M. Trout FSHN Bldg, Michigan State University, East Lansing, MI 48824-1224 alaimo@msu.edu.

If you have questions or concerns about your child's rights as a research participant, would like to obtain information or offer input, or would like to register a complaint about this study, you may contact, anonymously if you wish, the Michigan State University's Human Research Protection Program at 517-355-2180, Fax 517-432-4503, or e-mail irb@msu.edu or regular mail at 207 Olds Hall, MSU, East Lansing, MI 48824.

This consent form was approved by the Biomedical and Health Institutional Review Board (BIRB) at Michigan State University. Approved 8/31/10 – valid through 7/27/11. This version supersedes all previous versions. IRB # 09-582.

If your child would like to take part in this study and you agree:

- **Please complete and sign the form below.**
- **Send the Parent/Caregiver Consent Form with your child back to school. It can be included in the packet of beginning of the school year signature forms.**
- **Keep the duplicate copy of this consent form for your records.**

Please Check ONE box below:

☐ I AGREE to allow my child to participate in the MyGarden project

☐ I DO NOT want my child to participate in the MyGarden project

_____
Child's name

_____ _____ _____
Parent/Guardian Signature Printed Parent/Guardian Name Date

Thank you!

This consent form was approved by the Biomedical and Health Institutional Review Board (BIRB) at Michigan State University. Approved 8/31/10 – valid through 7/27/11. This version supersedes all previous versions. IRB # 09-582.

APPENDIX F: Assent Forms

SCHOOL GARDEN NUTRITION EDUCATION
MY GARDEN PROJECT
MICHIGAN STATE UNIVERSITY
STUDENT ASSENT FORM

Dear Student,

We are working on a project at your school to learn about the school garden. We are interested to learn about the garden at your school and your experiences with the garden. We hope that the information that we learn can be used to create more and better school gardens in Michigan.

I hope that you will participate in this project. By participating, I mean that you will allow a person who is working on the project to do two things:

1. Watch how you learn about and work in the garden.

2. Collect work you have completed as part of your activities in the garden during school or after school.

Your parent has already agreed that you can participate.

Your participation in this project is voluntary. Participation will not take you away from any class time. You will not receive any extra credit if you choose to participate in this study, and you will not lose credit if you choose not to participate in the study. If, at any time, you choose not to have your work included in the project, we will not use your work. You can quit being in this project at any time and you can refuse to interact with the researcher at any time. This project will not affect your grades.

There are no known risks involved in doing this project. Your privacy will be protected so that no one who sees your work will know your real name.

If you agree to participate in this research project, please sign below.

_____

Your Name

_____ _____

Your Signature Date

This consent form was approved by the Biomedical and Health Institutional Review Board (BIRB) at Michigan State University. Approved 8/31/10 – valid through 7/27/11. This version supersedes all previous versions. IRB # 09-582.

APPENDIX F: Assent Forms (contd.)

SCHOOL GARDEN NUTRITION EDUCATION
MY GARDEN PROJECT
MICHIGAN STATE UNIVERSITY
STUDENT ASSENT SCRIPT

I am working on a project at your school to learn about the school garden. I hope the information that I learn can be used to create more and better school gardens in Michigan.

I hope that you will participate in this project. By participating, you will allow a person who is working on the project to do two things:

3. Watch how you learn about and work in the garden.

4. Collect work you have done as part of your activities in the garden during school or after school.

Your parent has already agreed that you can participate. You can quit being in this project at any time and you can refuse to interact with the researcher at any time. This project will not affect your grades.

Would you like to be a part of the MyGarden research project?

YES

NO

This consent form was approved by the Biomedical and Health Institutional Review Board (BIRB) at Michigan State University. Approved 8/31/10 – valid through 7/27/11. This version supersedes all previous versions. IRB # 09-582.

APPENDIX G: Codebook for Qualitative Analysis

Code Name	Code Definition	Rules	Examples
Asks Question	Participant asks a question about the garden program		
Curricular: Benchmarks	Curricular benchmarks are mentioned		
Curricular: Challenges	Challenges regarding integrating the garden into curricular education are mentioned		
Curricular: Integration Possible	Mention in general terms that integrating the garden into curricular education is possible		
Curricular: Language Arts/Literacy	Garden-based activities used for Language Arts or Literacy education	Specific example or simply stating that it can be done	
Curricular: Math	Garden-based activities used for Math education	Specific example or simply stating that it can be done	
Curricular: Science	Garden-based activities used for Science education	Specific example or simply stating that it can be done	
Curricular: Social Studies/History	Garden-based activities used for Social Studies or History education	Specific example or simply stating that it can be done	

Code Name	Code Definition	Rules	Examples
Curricular: Willing to Incorporate	Mention of willingness by teacher or educator to incorporate garden activities into curricular education		
Experience: Community	Mention of community involvement or response to the garden program.	Also includes mention of community involvement that is not happening but that they hope will happen.	
Experience: Cultural	Mention of cultural considerations with respect to the garden program or food and nutrition at the school		
Experience: Education System	Participant view on educational system	This is a very broad code.	"The way we teach children does not work for all learning styles."
Experience: Garden is Worth it	Participant states or implies that the garden is worth the effort.		"Getting to see a kid eat a pepper ripe off the vine makes all of the paperwork worth it"
Experience: Home Environment	Mention of students home experience, home life, home environment. Including speculation.		
Experience: Parents/Family	Mention of parental or family involvement or response (feedback) to the garden program	Also includes mention of parental involvement that is not happening but that they hope will happen.	

Code Name	Code Definition	Rules	Examples
Experience: Poverty	Mention of poverty and its effects on students or community		
Experience: School Culture	Overall code for the "feeling" or "climate" at the school.		
Experience: School Wellness Facilitators	Descriptions of ideas or actions that help to improve school wellness	Not just nutrition or garden related	
Experience: Staff Relationship	Description of interpersonal relationships or the lack of interpersonal relationships between staff. Also a description or mention of communication between staff at the school.	Between all staff, including teachers, admin, and other staff.	
Food Service	Any interesting mention of food service not included in other Food Service codes.		
Food Service: Complaints	Complaints about any aspect of food service	Including school meals, and interaction with staff	
Food Service: Praise	Praise about any aspect of food service	Including school meals, and interaction with staff	

Code Name	Code Definition	Rules	Examples
Funding	Any mention of garden program funding or nutrition education funding.		
Funding: Evaluation	Any mention of evaluation requirements for program funding.		
Funding: Requirements	Any mention of program requirements or restrictions based on funding		
Garden: Activities	Description of activities that take place as a result of the garden program	This does not only include activities in the physical garden. This can be off campus field trips, cooking lessons in the classroom, or community events.	
Garden: Challenges	Any mention of challenges experienced by the garden program.	Challenges regarding food service, seasonality, or curricular integration do not belong in this code. Includes ideas on how to overcome challenges.	
Garden: Extra Effort	Any mention of teachers, administrators, or other staff putting in extra effort specifically with regards to the garden, or willingness to put in effort		

Code Name	Code Definition	Rules	Examples
Garden: Food/Eating/Cooking	Any mention of food, eating, or cooking related to or resulting from the garden program.		
Garden: Future	Descriptions of plans for the future of the garden program. Also thoughts on the feasibility and sustainability of the program as it is.		
Garden: More Time	Expresses a need for more time being spent by the students in the garden.		
Garden Program: Goals	Description of the reason for having the garden at the school.	Program goals and initial motivation should be included.	
Garden Program: Needs/Wishes	Any mention of hopes for the garden or of physical needs.	Hopes can include programming elements such as more teachers being involved. Physical needs would include tools, seeds, space, etc.	
Garden: Seasonal Barriers	Any mention of challenges experienced by the garden program as a result of season.		

Code Name	Code Definition	Rules	Examples
Garden: Stories	Participant provides a specific story related to the garden program.	This can be a story about students, teachers, staff, or community members.	
Garden: Teacher/Staff Values Garden	Any indication that the staff member values the garden		
Garden Program: New Ideas	Novel ideas or suggestions by teachers or other staff or students to improve the garden program		
Garden versus Classroom learning	Comparison made between garden-based and classroom-based learning.		
Grow it, Eat it	This code describes the repeated idea mentioned by teachers and other staff that if students grow the food, they are more likely to eat it.		
Hands On	Any mention of the idea of hands-on or experiential learning.		
Nutrition Education: Garden	Description of nutrition education activities used specifically in the garden		
Nutrition Education: Other	Description of nutrition all other nutrition education activities		

Code Name	Code Definition	Rules	Examples
Outcomes: Behavior	Description of actual behavior change witnessed in students	This should be a description of an actual experience of behavior change - not a description of possible outcomes. This refers specifically to Nutrition outcomes	
Outcomes: Brings People In	Mention or description of the garden program enriching the school by bringing in people- connecting the students with people who show them that they are valued	This is a very broad code.	
Outcomes: Character Development	Description of possible or actually witnessed character development as a result of gardening.		
Outcomes: Food/Earth Knowledge	Description of the garden teaching the students about where food comes from or about environmental issues		
Outcomes: Knowledge	Description of actual knowledge change witnessed in students	This should be a description of an actual experience of knowledge change - not a description of possible outcomes.	This refers specifically to Nutrition outcomes

Code Name	Code Definition	Rules	Examples
Outcomes: School-wide Impact	Description of the school-wide effects of the garden program specifically	These effects can be directly or indirectly related to the garden.	"Emily helped get rid of vending machines" "The mayor came to see the garden and the school was in the newspaper" "The third-graders have started their own flower garden. It makes the school look so nice"
Outcomes: Student Non-Academic	Description of non-academic and non-nutrition related outcomes of the garden program	Or possible outcomes - Merge with "Outcomes Possible - Other"	
Outcomes: Student Response Garden	Description of student response or interest in the garden		
Outcomes: Student Response Nutrition	Description of student response or interest in other nutrition activities	Such as cooking, or indoor nutrition lessons	
Outcomes Possible: Behavior	Description of student benefits/outcomes, specifically potential change in behavior.	This refers specifically to Nutrition outcomes	
Outcomes Possible: Attitude	Description of student benefits/outcomes, specifically potential change in attitude.	This refers specifically to Nutrition outcomes	
Outcomes Possible: Knowledge	Description of student benefits/outcomes, specifically potential change in knowledge	This refers specifically to Nutrition outcomes	

Code Name	Code Definition	Rules	Examples
Policy	Any mention of school policy		
Policy: Aware	Participant seems to be aware of policy	Even if they don't think they are aware	
Policy: Unaware	Participant does not seem to be aware of policy	Even if they think that they are aware	
Spontaneous Learning	Any mention or description of spontaneous learning that happens as a result of the garden program	This includes learning that happens in the physical garden or leaning that happens elsewhere as a result of the garden program	
Student Experience	This code describes the repeated idea by teachers that the students lack "experiences" and that the garden is an enriching experience in the lives of the students.		"Most of the students live in apartment complexes, surrounded by concrete. They actually rarely leave the city. The garden provides them with an experience that they would never otherwise have."
Student Food Preference	Any mention of student food preferences	Perceived by teachers or a more evidence based description	"The student love spinach - the just devour it!" "They eat foods that kids don't usually like, like broccoli"

Code Name	Code Definition	Rules	Examples
Subjective Norm: Teachers	Description by teachers of how they think others at the school view the garden		
Support: Administrative	Any mention of administrative support, or lack of administrative support.		
Support: Other	Any mention of other types of support, or lack of other types of support	Support from other teachers, community, parents. This does not include funding support.	
Take Home	Any mention of the students taking home food or other artifacts, including recipes, from the garden or the garden program.		
Teacher Experience: Concern for Diet/Hunger	Any mention of a teacher or staff person being concerned about what children are eating at home or at school. Also mention of concern about hunger and proper nutrition.	Can also include concerns about diet related disease and obesity.	
Teacher Experience: Difficult to Use Garden	Mention or description of the garden being difficult to use.		
Teacher Experience: Easy to Use Garden	Mention or description of the garden being easy to use.		

Code Name	Code Definition	Rules	Examples
Teacher Experience: Interest	Mention of teachers being interested in participating in garden program		
Teacher Experience: Not Engaged in Garden	Description of teachers not being engaged or participating, or having a knowledge of the garden.		
Teacher Experience: Overtaxed	Any mention of the burden that teachers face.		
Teacher Experience: What Helps Teachers	Descriptions of factors that help get teachers interested and help facilitate teachers actually using the garden in the classroom.	Can also include more general descriptions of factors that help teachers to integrate enriching activities (other than the garden) into their classroom.	
Teacher Experience: Why Teachers DO Participate	A description of why teachers participate in the garden program.		
Teacher Experience: Why Don't Participate	A description of why teachers do not participate in the garden program. Barriers to participation		

REFERENCES

REFERENCES

Aldridge, J. & Sempik, J. (2002). Social and therapeutic horticulture: evidence and messages from research. *Centre for Child and Family Research Evidence Issue*, 6, 1-4. Retrieved from http://www.lboro.ac.uk/research/ccfr/Publications/Evidence6.pdf

Alexander, J., North, M. & Hendren, D. (1995). Master gardener classroom garden project: An evaluation of the benefits to children. *Childrens Environments*, 12(2), 124-133.

Association for Experimental Education. (2011). *What is experiential Education?* Retrieved from http://www.aee.org/about/whatIsEE

ATLAS.ti. GmbH Version 5.7.1. [Computer software] (2011) Berlin, Scientific Software Development

Basch, C.E., Sliepcevich E.M., Gold R.S., Duncan, D. & Kolbe L. (1985). Avoiding Type III errors in health education program evaluations: A case study. *Health Education Quarterly*, 12, 315-331. doi:10.1177/109019818501200311

Baranowski, T., Davis, M., Resnicow, K., Baranowski, J., Doyle, C., Lin, L., . . . Wang, D. T. (2000a). Gimme 5 fruit, juice, and vegetables for fun and health: Outcome evaluation. *Health Education Behavior*, 27(1), 96-111. doi:10.1177/109019810002700109

Baranowski, T., Davis, M., Resnicow, K., Baranowski, J., Doyle, C., Lin, L., . . . Wang, D. T. (2000b). Gimme 5 fruit, juice, and vegetables for fun and health: Process evaluation. Health Educ Behav 27(1): 96-111. doi:10.1177/109019810002700109

Barney, M. W. E. (ca. 1919?). *Follow the pied piper. Join the United States School Garden Army.* [Photograph of poster]. Prints & Photographs Online Catalog, Library of Congress. Retrieved from http://www.loc.gov/pictures/collection/wwipos/item/95506493/

Barton, A. C., Koch, P. D., Contento, I. R. & Hagiwara, S. (2005). From global sustainability to inclusive education: Understanding urban children's ideas about the food system. *International Journal of Science Education*, 27(10), 1163-1186. doi:10.1080/09500690500069467

Bazzano, L. A. (2006). The high cost of not consuming fruits and vegetables. *Journal of the American Dietetic Association*, 106(9), 1364-1368. doi:10.1016/j.jada.2006.06.021

Bazzano, L. A., He, J., Ogden, L. G., Moria, C. M., Vupputuri, S., Myers, L. & Whelton, P. K. (2002). Fruit and vegetable intake and risk of cardiovascular disease in US adults: the first National Health and Nutrition Examination Survey Epidemiologic Follow-up Study. *American Journal of Clinical Nutrition*, 76, 93–99.

Berenson, G. S., Srinivasan, S. R., & Nicklas, T. A. (1998). Atherosclerosis: A nutritional disease of childhood. *American Journal of Cardiology*, 82(10 suppl2), 22T-29T.

Birch, L. L. & Fisher, J. O. (1998). Development of eating behaviors among children and adolescents. *Pediatrics*, 101, 539-549.

Biro, F. M. & Wien, M. (2010). Childhood obesity and adult morbidities. *American Journal of Clinical Nutrition*, 91(suppl),1499S-1505S. doi:10.3945/ajcn.2010.28701B

Blair, D. (2009) The child in the garden: An evaluative review of the benefits of school gardening. *Journal of Environmental Education*, 40(2), 15-38. doi:10.3200/JOEE.40.2.15-38

Blanchette, L. & Brug, J. (2005). Determinants of fruit and vegetable consumption among 6-12 year old children and effective interventions to increase consumption. *Journal of Human Nutrition and Dietetics*, 18, 431-443.

Boeing, H., Dietrich, T., Hoffman, K., Pischon, T., Ferrari, P., Lahmann, P. H., . . . Riboli, E. (2006). Intake of fruits and vegetables and risk of cancer of the upper aero-digestive tract: the prospective EPIC-study. *Cancer Causes & Control*, 17, 957-969. doi:10.1007/s10552-006-0036-4

Bowker, R. & Tearle, O. (2007). Gardening as a learning environment: A study of children's perceptions and understanding of school gardens as part of an international project. *Learning Environments Research*, 10:83-100. doi:10.1007/s10984-007-9025-0

Briggs, M. & Safai, S. Position of the American Dietetic Association, Society for Nutrition Education, and American School Food Service Association: Nutrition services: An essential component of comprehensive school health programs. (2003) *Journal of the American Dietetic Association*, 35(2), 57-67. doi:10.1053/jada.2003.50100

Brug, J., Tak, N. I., te Velde, S. J., Bere, E. & de Bourdeaudhuij, I. (2008). Taste preferences, liking and other factors related to fruit and vegetable intakes among schoolchildren: results from observational studies. *British Journal of Nutrition*, 99(suppl. 1), S7-S14. doi:10.1017/S0007114508892458

Calle, E. E., Rodriguez, C., Walker-Thurmond, K. & Thun, M. J. (2003). Overweight, obesity, and mortality from cancer in a prospectively studied cohort of U.S. adults. *New England Journal of Medicine*, 348, 1625-38.

Canaris, I. (1995). Growing foods for growing minds: Integrating gardening and nutrition education into the total curriculum. *Children's Environments*, 12(2), 134-142.

Carter, C. (2010). Transcript of School Gardens with Constance Carter. Library of Congress. Retrieved from http://www.loc.gov/rr/program/journey/schoolgardens-transcript.html

Carver, R. (1996). Theory for practice: A framework for thinking about experiential education. *Journal of Experiential Education*, 19(1), 8-13.

Coley, R. L., Sullivan, W. C. & Kuo, R. E. (1997). Where does community grow? : The social context created by nature in urban public housing. Environment and Behavior, 29, 468-494. doi:10.1177/001391659702900402

Contento, I. (1995a). Nutrition education for school-aged children. *Journal of Nutrition Education*, 27(6), 298-311.

Contento, I. (1995b). Theoretical frameworks or models for nutrition education. *Journal of Nutrition Education*, 27(6), 287-290.

Contento, I. *(2007). Nutrition education: Linking research, theory, and practice. Sudbury, MA: Jones and Bartlett Publishers.*

Corbin, J., Strauss, A. (1990). Grounded theory research: Procedures, canons, and evaluative criteria. *Qual Sociol*, 13(1), 3-21.

Creswell, J.W. (2007) *Qualitative Inquiry and Research Design*. London: Sage.

Cullen, K. W., Baranowski, T., Owens, E., Marsh, T., Rittenberry, L. & de Moor, C. (2003). Availability, accessibility, and preferences for fruit, 100% fruit juice, and vegetables influence children's dietary behavior. *Health Education Behavior*, 30, 615-626. doi:10.1177/1090198103257254

Desmond, D., Grieshop, J. & Subramanium, A. (2004). *Revisiting garden based learning in basic education*. Rome: Food and Agriculture Organization of the United Nations. Retrieved from http://www.fao.org/sd/erp/revisiting.pdf

Dewey, J. (1916). *Democracy and education: An introduction to the philosophy of education*. New York: The Macmillan Company. Retrieved from http://etext.lib.virginia.edu/etcbin/toccernew2?id=DewDemo.sgm&images=images/modeng&data=/texts/english/modeng/parsed&tag=public&part=all

Dewey, J. (1938). *Experience and education*. New York: Collier Books. 1938.

Dirks, A. E. & Orvis, K. (2005). An evaluation of the junior master gardener program in third grade classrooms. *Hort Technology*, 15, 443-447.

Domel, S. B., Baranowski, T., Davis, H., Leonard, S.B., Riley, P. & Baranowski, J. (1993). Measuring fruit and vegetable preferences among 4th- and 5th-grade students. *Preventive Medicine*, 22, 866-879.

Domel, S. B., Thompson, W.O., Davis, H.C., Baranowski, T., Leonard, S.B. & Baranowski, J. (1996). Psychosocial predictors of fruit and vegetable consumption among elementary school children. *Health Education Research*, 11(3), 299-308.

Duncan, K.H., Bacon J. A. & Weinsier, R. L. (1983). The effects of high and low energy density diets on satiety, energy intake, and eating time of obese and nonobese subjects. *American Journal of Clinical Nutrition*, 37, 763-767.

Epstein, L. H., Gordy, C. C., Raynor, H. A., Beddome, M., Kilanowski, C. K. & Paluch R. (2001). Increasing fruit and vegetable intake and decreasing fat and sugar intake in families at risk of childhood obesity. *Obesity*, 9(3), 171-178. doi:10.1038/oby.2001.18

Ervin, R., Wright, J., Wang, C. & Kennedy-Stephenson, J. (2004). Dietary intake of selected vitamins for the United States population: 1999-2000. *Advance Data*, 339:1-4.

Fisher, J. & Birch, L. (2001). Early experience with food and eating: Implications for the development of eating disorders. In J. Thompson, & L. Smolak, (Eds). *Body image, eating disorders, and obesity in youth: Assessment, prevention, and treatment* (pp. 23-39). Washington, DC: American Psychological Association.

Florence, M. D., Asbridge, M. & Veugelers, P. J. (2008). Diet quality and academic performance. Journal of School Health, 78(4), 209-215. doi:10.1111/j.1746-1561.2008.00288.x

Food Research and Action Center. (2009) *Hunger in the U.S.* Retrieved from http://www.frac.org/html/hunger_in_the_us/hunger_index.html

Freedman, D. S., Dietz, W. H., Srinivasan, S. R. & Berenson, G. S. (1999). The relation of overweight to cardiovascular risk factors among children and adolescents: The Bogalusa Heart Study. *Pediatrics*, 103(6), 1175-1182. doi:10.1542/peds.103.6.1175

French, S. A. & Stables G. (2003). Environmental interventions to promote vegetable and fruit consumption among youth in school settings. *Preventive Medicine*, 37(6), 593-610. doi:10.1016/j.ypmed.2003.09.007

Graham, H., Beall, D. L., Lussier, M., McLaughlin, P. & Zidenberg-Cherr, S. (2005a). Use of school gardens in academic instruction. *Journal of Nutrition Education and Behavior*, 37(3), 147-151. doi:10.1016/S1499-4046(06)60269-8

Graham, H. & Zidenberg-Cherr, S. (2005b). California teachers perceive school gardens as an effective nutritional tool to promote healthful eating habits. *Journal of the American Dietetic Association*, 105(11), 1797-1800. doi:10.1016/j.jada.2005.08.034

Guenther, P. M., Dodd, K.W., Reedy, J. & Krebs-Smith, S. M. (2006). Most Americans eat much less than recommended amounts of fruits and vegetables. *Journal of the American Dietetic Association*, 106(9), 1371-1379. doi:10.1016/j.jada.2006.06.002

Hannon, T. S., Rao, G, and Arslanian, S. A. (2005). Childhood obesity and type 2 diabetes mellitus. *Pediatrics*, 2005, 116(2), 473-480. doi:10.154**2**/peds.**2**004-**2**536

Hayden-Smith, R. (2006). Soldiers of the soil: A historical review of the United States School Garden Army. *Monograph, University of California*. Retrieved from http://groups.ucanr.org/victorygrower/files/47755.pdf

He, F.J., Nowson, C.A. & MacGregor, G.A. (2006) Fruit and vegetable consumption and stroke: Meta analysis of cohort studies. *Lancet*, 367, 320-326. doi:10.1016/S0140-6736(06)68069-0

He, K., Hu, F. B., Colditz, G. A., Monson J. E., Willet W. W., & Liu S. (2004). Changes in intake of fruits and vegetables in relation to risk of obesity and weight gain among middle-aged women. *International Journal of Obesity*, 28, 1569–1574. doi:10.1038/sj.ijo.0802795

Heim, S., Stang, J. & Ireland, M. (2009). A garden pilot project enhances fruit and vegetable consumption among children. *Journal of the American Dietetic Association*, 109(7), 1220-1226. doi:10.1016/j.jada.2009.04.009

Hermann, J. R., Parker, S. P., Brown, B. J., Siewe, Y. J., Denney, B. A. & Walker, S. J. (2006). After-school gardening improves children's reported vegetable intake and physical activity. *Journal of Nutrition Education and Behavior*. 38(3), 201-202. doi:10.1016/j.jneb.2006.02.002

Heron, M. Deaths: Leading causes for 2006. (2010) *National Vital Statistics Reports*, 58(14). Retrieved from http://www.cdc.gov/nchs/data/nvsr/nvsr58/nvsr58_14.pdf

Herriott, R. E. & Firestone, W. A. (1983). Multisite qualitative policy research: Optimizing description and generalizability. *Educational Researcher*, 12(2), 14-19.

Hu, F. B. & Willett, W. C. (2002). Optimal diets for prevention of coronary heart disease. *Journal of the American Medical Association*, 288(20), 2569-2578. doi:10.1001/jama.288.20.2569

Joshipura K.J., Ascherio, A., Manson, J. E., Stampfer, M. J., Rimm, E. B., Speizer, F. E., . . . Willett, W. C. (1999). Fruit and vegetable intake in relation to risk of ischemic stroke. *Journal of the American Medical Association*, 282, 1233-1239. doi:10.1001/jama.282.13.1233

Joshipura, K. J., Hu, F. B., Manson, J.E., Stampfer, M.J., Rimm, E.B., Speizer, F.E., . . . Willett, W. (2001). The effect of fruit and vegetable intake on risk for coronary heart disease. *Annals of Internal Medicine*, 134, 1106-1114.

Kaiser, L. L., Melgan-Quinonez, H., Townsend, M. S., Nicholson, Y., Lavender Fuji, M., . . . Lamp, C. L. (2003). Food insecurity and food supplies in Latino households with young children. *Journal of Nutrition Education and Behavior*, 35(3), 148-153.

Kids Gardening. (2010). *Evaluation Summary – NGA Grant Winners*. Retrieved from http://www.kidsgardening.com/grants/2010-evaluation-summary.asp

Kendall, A., Olson, C. & Frongillo, E. A. (1996). Relationship of hunger and food insecurity to food availability and consumption. *Journal of the American Dietetic Association*, 96(10), 1019-1024. doi:10.1016/S0002-8223(96)00271-4

Kleinman, R.E., Hall, S., Green, H., Korzec-Ramirez, D., Patton, K., Pagano, M. E. & Murphy, J. M. (2002). Diet, breakfast, and academic performance in children. *Annals of Nutrition and Metabolism*, 46(suppl 1), 24-30. doi:10.1159/000066399

Kleinman, R. E., Murphy, J. M., Little, M., Pagano M, Wehler, C. A., Regal, K. & Jellinek, M. S. (1998). Hunger in children in the United States: Potential behavioral and emotional correlates. *Pediatrics*, 101, e3. doi:10.1542/peds.101.1.e3

Klemmer, C.D., Waliczek, T. M. & Zajicek, J. M. (2005). Growing minds: The effect of a school gardening program on the science achievement of elementary students. *Hort Technology*, 15(3), 448-452).

Kolb, D. A. (1985) *Experiential Learning: Experience as the Source of Learning and Development*. Upper Saddle River, NJ: Prentice Hall.

Kris-Etherton, P. M., Lefevre, M., Beecher, G. R., Gross, M.D., Keen, C.L. & Etherton, T. D. (2004). Bioactive compounds in nutrition and health-research methodologies for establishing biological function: the antioxidant and anti-inflammatory effects of flavonoids on atherosclerosis. *Annual Reviews of Nutrition*, 24, 511–38. doi:10.1146/annurev.nutr.23.011702.073237

Kristjansdottir, A. G., Thorsdottir, I., De Bourdeaudhuji, I., Due, P., Wind, M. & Kleppp, K. (2006). Determinants of fruit and vegetable intake among 11 year-old schoolchildren in a country of traditionally low fruit and vegetable consumption. International Journal of Behavioral Nutrition and Physical Activity, 3(41). doi: 10.1186/1479-5868-3-41

Larson, N. I., Story, M. T. & Nelson, M. C. (2009). Neighborhood environments- Disparities in access to healthy foods in the U.S. *American Journal of Preventive Medicine*, 36(1),74-81e10. doi:10.1016/j.amepre.2008.09.025

Lather, P. (1986). Research as praxis. *Harvard Educational Review*, 56(3), 257-277.

Lautenschlager, L. & Smith, C. (2007) Understanding gardening and dietary habits among youth garden program participants using the Theory of Planned Behavior. *Appetite*, 49, 122–130. doi:10.1016/j.appet.2007.01.002

Lieberman, G. A. & Hoody, L. L. (1998). *Closing the achievement gap: Using the environment as an integrating context for learning*. San Diego: State Education and Environment Roundtable. Retrieved from: http://www.seer.org/extras/execsum.pdf

Lin, B & Morrison, R. (2002). Higher fruit consumption linked with lower body mass index. *Food Review*, 25, 28-37. Retrieved from http://www.ers.usda.gov/publications/foodreview/dec2002/frvol25i3d.pdf

Lincoln, Y. & Guba, E. (1985). *Naturalistic inquiry*. Newbury Park, CA: Sage.

Lincoln, Y. (1995). Emerging criteria for quality in qualitative and interpretive research. *Qualitative Inquiry*, 1(3), 275-289.

Lineberger, S. E. & Zajicek, J. M. (2000). School gardens: Can a hands-on teaching tool affect students' attitudes and behaviors regarding fruit and vegetables? *Hort Technology,* 10(3), 593-597.

Lytle, L. & Achterberg, C. (1995). Changing the diet of America's children: What works and why? *Journal of Nutrition Education,* 27(5), 250-260.

Lytle, L. A., Stone, E. J., Nichaman, M. Z., Perry, C. L., Montgomery, D. H., Nicklas, T. A., . . . Galati, T. P. (1996). Changes in nutrient intakes of elementary school children following a school-based intervention: Results from the CATCH Study. *Preventive Medicine*, 25(4), 465-477. doi:10.1006/pmed.1996.0078

Martin, C. L. (2011). Lessons from the garden: Garden-based nutrition education at two elementary schools (Unpublished master's thesis). Michigan State University, East Lansing, MI.

McAleese, J. D. & Rankin, L. L. (2007). Garden-based nutrition education affects fruit and vegetable consumption in sixth-grade adolescents. *Journal of the American Dietetic Association,* 107(4), 662-665. doi:10.1016/j.jada.2007.01.015

Meyer, E. (ca. 1944). *New York, New York. Children's school victory gardens on First Avenue between Thirty-fifth and Thirty-sixth Streets.* [Photograph of children and teacher in garden]. Prints & Photographs Online Catalog, Library of Congress. Retrieved from http://www.loc.gov/pictures/item/owi2001039484/PP/

Michigan Department of Education. (2001). *The role of Michigan schools in promoting healthy weight*. Retrieved from http://www.michigan.gov/documents/healthyweight_13649_7.pdf

Michigan Department of Education. (2009). *Youth Risk and Behavior Survey: Weight and nutrition fact sheet*. Retrieved from http://www.michigan.gov/documents/mde/2009-WN_333608_7.pdf

Mikkila, V., Rasanen, L., Raitakari, O. T., Pietinen, P. & Viikari, J. (2005). Consistent dietary patterns identified from childhood to adulthood: The Cardiovascular Risk in Young Finns Study. *British Journal of Nutrition,* 93, 923-931. doi:10.1079/BJN20051418

Mokdad, A. H., Marks, J.S., Stroup, D. F. & Gerberding, J. L (2004). Actual causes of death in the united states, 2000. *Journal of the American Medical Association,* 291(10), 1238-1245. doi:10.1001/jama.291.10.1238

Morgan, P. J., Warren, J. M., Lubans, D. R., Saunders, K. L., Quick, G. I. & Collins, C. E. (2010). The impact of nutrition education with and without a school garden on knowledge, vegetable intake and preferences and quality of school life among primary-school students. *Public Health Nutrition,* 13(11), 1931-1940. doi:10.1017/S1368980010000959

Morland, K. & Filomena, S. (2007). Disparities in the availability of fruits and vegetables between racially segregated urban neighbourhoods. *Public Health Nutrition,* 10(12), 1481–1489. doi:10.1017/S1368980007000079

Morris, J. L., Briggs, M. & Zidenberg-Cherr, S. (2000). School-based gardens can teach kids healthier eating habits. *California Agriculture,* 54(5), 40-46. doi:10.3733/ca.v054n05p40

Morris, J. L. & Zidenberg-Cherr, S. (2002). Garden-enhanced nutrition curriculum improves fourth-grade school children's knowledge of nutrition and preferences for some vegetables. *Journal of the American Dietetic Association,* 102(1), 91-93. doi:10.1016/S0002-8223(02)90027-1

National Gardening Association. (2011). Garden in Every School® Search. Retrieved from http://kidsgardening.com/School/searchform.asp

New York City Department of Parks and Recreation. (2011). Farm Gardens. Retrieved from http://www.nycgovparks.org/sub_about/parks_history/gardens/farm.html

Nicklas, T. A., Baranowski, T., Cullen, K. W. & Berenson, G. (2001). Eating patterns, dietary quality and obesity. *Journal of the American College of Nutrition,* 20(6), 599-608.

Nicklas, T. & Johnson, R. (2004). Position of the American Dietetic Association: dietary guidance for healthy children ages 2-11 years. *Journal of the American Dietetic Association,* 104(4), 660-677. doi:10.1016/j.jada.2004.01.030

Ober Allen, J., Alaimo, K., Elam, D. & Perry, E. (2008). Growing vegetables and values: Benefits of neighborhood-based community gardens for youth developments and nutrition. *Journal of Hunger and Environmental Nutrition,* 3(4), 418-439. doi:10.1080/19320240802529169

Ogden, C. L., Carroll, M. D., Curtin, L. R., McDowell, M. A., Tabak, C. J. & Flegal, K. M. (2006). Prevalence of overweight and obesity in the United States, 1999-2004. *Journal of the American Medical Association,* 295(13), 1549-1555. doi:10.1001/jama.295.13.1549

Orr D. (1994). *Earth in mind: On education, environment, and the human prospect*. Washington, DC: Island Press.

Orr, D. (1992). *Ecological literacy: Education and the transition to a postmodern world*. Albany: State University of New York Press.

Ozer, E. (2007). The effects of school gardens on students and schools: Conceptualization and considerations for maximizing healthy development. *Health Education and Behavior,* 34(6), 846-863. doi: 10.1177/1090198106289002

Parmer S. M., Salisbury-Glennon, J., Shannon, D. & Struempler, B. (2009). School gardens- an experiential learning approach for a nutrition education program to increase fruit and vegetable knowledge preference and consumption among second grade students. *Journal of Nutrition Education and Behavior*, 41(3), 212- 217. doi:10.1016/j.jneb.2008.06.002

Pinhas-Hamiel, O., Dolan, L. M., Daniels, S. R., Standiford, D., Khoury, P. R. & Zeitler, P. (1996). Increased incidence of non-insulin-dependent diabetes mellitus among adolescents. *Journal of Pediatrics,* 128(5), 208-215. doi:10.1016/S0022-3476(96)80124-7

Ratcliffe, M. M., Merrigan, K. A., Rogers, B. L. & Goldberg, J. P. (2011). The effects of school garden experiences on middle school-aged students' knowledge, attitudes, and behaviors associated with vegetable consumption. *Health Promotion Practice,* 12(1), 36-43. doi:10.1177/1524839909349182

Resnicow, K., Davis-Hearn, M., Smith, M., Baranowski, T., Lin, L.S., Baranowski, J., . . . Wang, D.T. (1997). Social-cognitive predictors of fruit and vegetable intake in children. *Health Psychology*, 16(3), 372-276. doi:10.1037/0278-6133.16.3.272

Reynolds, K. D., Hinton, A. W., Shewchuk, R. M. & Hickey, C. A. (1999). Social cognitive model of fruit and vegetable consumption in elementary school children. *Journal of Nutrition Education*, 21, 23-30.

Ritchie L. D., Crawford, P. B., Hoelscher, D. M. & Sothern, M. S. (2006). Position of the American Dietetic Association: Individual-, family-, school-, and community-based interventions for pediatric overweight. *Journal of the American Dietetic Association,* 106, 925-945. doi:10.1016/j.jada.2006.03.001

Robinson, C. W. & Zajicek, J. M. (2005). Growing minds: The effects of a one-year school garden program on six constructs of life skills of elementary school children. *Hort Technology,* 15(3), 453-457.

Robinson-O'Brien, R., Story, M., & Heim. S. (2009). Impact of garden-based youth nutrition intervention programs: A review. *Journal of the American Dietetic Association*, 109(2), 273-280. doi:10.1016/j.jada.2008.10.051

Sallis, J. F., McKenzie, T. L., Conway, T. L., Elder, J. P., Prochaska, J. J., Brown, M., . . . Alcaraz, J. E. (2003). Environmental interventions for eating and physical activity: A randomized controlled trial in middle schools. *American Journal of Preventive Medicine*, 24(3), 209-217. doi:10.1016/S0749-3797(02)00646-3

Sargeant, L. A., Khaw, K. T., Bingham, S., Day, N. E., Luben, R. N., Oakes, S., . . . Wareham, N. J. (2001). Fruit and vegetable intake and population glycosylated haemoglobin levels: the EPIC-Norfolk Study. *European Journal of Clinical Nutrition*, 55, 342-348.

Schwab, E. (1879). The school garden. Being a practical contribution to the subject of education. Retrieved from http://beta.biodiversitylibrary.org/item/78917#page/5/mode/1up

Scott, A. (2011). *MyGarden™:Process Report 2007-2010*. Unpublished report, CS Mott Group for Sustainable Food Systems at Michigan State University, East Lansing, Michigan.

Singer, M. R., Moore, L. L., Garrahie, E. J. & Ellison, R. C. (1995). The tracking of nutrient intake in young children: The Framingham Children's Study. *American Journal of Public Health*, 85(12), 1673-1677.

Sobel, D. (2005) *Place-Based Education: Connecting Classrooms & Community*. Great Barrington: The Orion Society.

Somerset, S. & Markwell, K. (2008). Impact of a school-based food garden on attitudes and identification skills regarding vegetables and fruit: a 12-month intervention trial. *Public Health Nutrition*, 12(2), 214-221. doi:10.1017/S1368980008003327

Soraf, J. & Daniels, S. (2002). Obesity hypertension in children: A problem of epidemic proportions. *Hypertension*, 40, 441-447. doi:10.1161/01.HYP.0000032940.33466.12

Stake, R. E. (1995). *The art of case study research*. Thousand Oaks, CA: Sage.

Stang, J., Taft Bayerl, C. & Flatt M. M. (2006) Position of the American Dietetic Association: Child and adolescent food and nutrition programs. *Journal of the American Dietetic Association,* 106(9),1467-1475. doi 10.1016/j.jada.2006.07.027

Steinberger, J., Moran, A., Hong, C., Jacobs, D., & Sinaiko, A. (2001). Adiposity in childhood predicts obesity and insulin resistance in young adulthood. *Pediatrics*, 138(4), 469-473. doi:10.1067/mpd.2001.112658

Steinmetz, K. A. & Potter, J. D. (1991). Vegetables, fruit, and cancer. II. Mechanisms. *Cancer Causes & Control*, 2, 427-442. doi:10.1007/BF00054304

Steinmetz, K.A. & Potter, J. D. (1996). Vegetables, fruit, and cancer prevention: A review. *Journal of the American Dietetic Association*, 96, 1027-1039. doi:10.1016/S0002-8223(96)00273-8

Story, M., Kaphingst, K. M., & French, S. (2006). The role of schools in obesity prevention. *The Future of Children*, 16(1), 109-142.

Story, M., Neumark-Sztainer, D. & French, S. (2002). Individual and environmental influences on adolescent eating behaviors. *Journal of the American Dietetic Association*, 102(3 suppl), S40-51.

Taylor, A. F., Wiley, A., Kuo, F. E. & Sullivan, W. C. (1998). Growing up in the inner city-Green Spaces and places to grow. *Environment and Behavior*, 30(1), 3-27. doi:10.1177/0013916598301001

Thorp, L. (2001, December). *Agricultural education in an elementary school: An ethnographic study of a school garden*. Paper presented at the meeting of the 28th Annual National Agricultural Education Research Conference, New Orleans, LA.

Thorp, L. (2006). *The pull of the earth: Participatory ethnography in the school garden*. New York: Alta Mira Press.

United States Census Bureau. (2003) *School Enrollment: 2000. Census 2000 Brief*. Retrieved from http://www.census.gov/prod/2003pubs/c2kbr-26.pdf

United States Census Bureau. (2011). *American Fact Finder*. Retrieved from http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml

United States Department of Agriculture. (2011) *Dietary Guidelines for Americans, 2010*. Retrieved from http://www.cnpp.usda.gov/dietaryguidelines.htm

United States Department of Agriculture. (2011). MyPyramid Food Groups. Retrieved from http://www.mypyramid.gov/pyramid/index.html

United States Department of Agriculture. (2010). SNAP-Ed plan guidance, FY 2012. Retrieved from http://www.nal.usda.gov/fsn/Guidance/FY2012SNAP-EdGuidance.pdf

United States Department of Agriculture, Economic Research Service. (2011). *Food security in the United States: Key statistics and graphics*. Retrieved from http://www.ers.usda.gov/Briefing/FoodSecurity/stats_graphs.htm#food_secure

United States Department of Health and Human Services. (2010). *Healthy People 2020*. Retrieved from http://www.healthypeople.gov/2020/default.aspx

United States Department of Health and Human Services. (2010). *Nutrition and Weight Status Objectives*. Retrieved from http://www.healthypeople.gov/2020/topicsobjectives2020/objectiveslist.aspx?topicid=29

United States Department of Health and Human Services. (2001). *The Surgeon General's call to action to prevent and decrease overweight and obesity, setting 2: Schools.* Retrieved from http://www.surgeongeneral.gov/topics/obesity/calltoaction/CalltoAction.pdf

United States Department of Health and Human Services, Centers for Disease Control and Prevention. (1996). Guidelines for school health programs to promote lifelong healthy eating. *Morbidity and Mortality Weekly Report*, 45, 1-41. Retrieved from http://www.cdc.gov/mmwr/preview/mmwrhtml/00042446.htm

United States Department of Health and Human Services, Centers for Disease Control and Prevention. (2010). *Morbidity and Mortality Weekly Report. Surveillance Summaries: Youth Risk Behavior Surveillance-United States, 2010*. Retrieved from http://www.cdc.gov/mmwr/pdf/ss/ss5905.pdf

United States Department of Health and Human Services, Centers for Disease Control and Prevention. (2011). *Overweight and obesity: Defining childhood overweight and obesity*. Retrieved from http://www.cdc.gov/obesity/childhood/defining.html

United States Department of Health and Human Services, National Institutes of Health, National Cancer Institute. (2010). *Cancer trends progress report – 2009/2010 update: Fruit and vegetable consumption*. Retrieved from http://progressreport.cancer.gov/doc_detail.asp?pid=1&did=2007&chid=71&coid=707#target

Van Duyn, M. S. & Pivonka, E. (2000) Overview of the health benefits of fruit and vegetable consumption for the dietetics professional: selected literature. *Journal of the American Dietetic Association*, 100(12), 1511-1521. doi:10.1016/S0002-8223(00)004 20-X

Voorrips, L. E., Goldbohm, R. A., Verhoeven, T. H, van Poppel G. A.F.C., Sturmans, F., Hermus R. J. J., van den Brandt, P. A. (2000). Vegetable and fruit consumption and lung cancer risk in the Netherlands Cohort Study on diet and cancer. *Cancer Causes & Control*, 11, 101-115.

Westenhoefer, J. (2002) Establishing dietary habits during childhood for long-term weight control. *Annals of Nutrition and Metabolism*, 46(suppl1), 18-23. doi:10.1159/000066396

Yin, R.K. (2003). *Case Study Research: Design and Methods*. London: Sage.

Zenk, S. N., Schulz, A. J., Israel, B. A., James, S. A., Bao, S. & Wilson, M. L. (2005). Neighborhood racial composition, neighborhood poverty, and the spatial accessibility of supermarkets in metropolitan Detroit. *American Journal of Public Health*, 95(4), 660-667. doi:10.2105/AJPH.2004.042150