

**USING SCHOOL GARDENS AS A VEHICLE FOR HEALTH PROMOTION FOR
ELEMENTARY SCHOOL YOUTH: A REVIEW OF THE LITERATURE**

by

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Gardens have been incorporated into elementary school education since the 1800s and are gaining popularity once again. The growing interest in school gardens stems from recent trends toward eating locally grown food as well as public health concerns about improving the nutrition of youth. School garden programs can be utilized as a vehicle for improving the health and well being of elementary school youth, in both low and non-low socioeconomic (SES) elementary schools. A review of the literature indicates that school garden programs have been successful in improving academic achievement, increasing fruit and vegetable consumption and nutrition knowledge, building social skills, interpersonal relationships and team-building skills among elementary school youth. Through hands-on learning, gardens can enhance classroom lessons while providing youth with environmental experiences. However, barriers to successful implementation exist especially in low SES schools. These include: a lack of funding, the onus of responsibility is placed on teachers who lack knowledge of gardening skills, and little community and parent involvement. Some recommendations for improving school garden programs in order to increase sustainability and success include: 1) provide gardening techniques, skills and tips on how to incorporate gardens into classroom lessons during pre-service education for early education teachers, 2) include community volunteers to alleviate the burden on teachers, 3) complete garden program evaluations.

TABLE OF CONTENTS

PREFACE.....	VIII
1.0 INTRODUCTION.....	1
2.0 BACKGROUND	4
2.1 HISTORY OF SCHOOL GARDENS.....	4
2.2 OVERVIEW OF SCHOOL GARDEN PROGRAMS	6
2.3 FACTORS CONTRIBUTING TO SCHOOL GARDEN SUCCESS	8
3.0 METHODOLOGY.....	11
3.1 DATA COLLECTION.....	11
3.2 DEFINITION OF TERMS	12
3.3 LIMITATIONS AND PROBLEMS ENCOUNTERED.....	13
4.0 FINDINGS	14
4.1 PURPOSES OF ELEMENTARY SCHOOL GARDEN PROGRAMS	14
4.1.1 Academic	14
4.1.2 Lifestyle.....	18
4.1.3 Health Benefits.....	20
4.2 BARRIERS TO SUCCESS AND SUSTAINABILITY	27
4.2.1 Teacher Training and Curriculum Materials.....	27
4.2.2 Parent and Community Involvement	29

4.2.3	Funding.....	31
5.0	DISCUSSION AND RECOMMENDATIONS.....	34
5.1	DISCUSSION.....	34
5.1.1	Common findings.....	34
5.1.2	Sustaining gardens in low and non-low SES elementary schools.....	36
5.1.3	School gardens versus community gardens in areas of low SES.....	40
5.2	RECOMMENDATIONS	41
6.0	CONCLUSION.....	43
	BIBLIOGRAPHY	45

LIST OF TABLES

Table 1 Literature reviewed for the purposes and goals of school garden programs	25
Table 2 Literature reviewed for the barriers to school garden success.....	33

PREFACE

I wish to acknowledge the support and contributions of my thesis committee: Judith Dodd, Dr. Chris Keane and Dr. Jeanette Trauth. I extend a special thank you to Dr. Trauth for all her effort helping me make this thesis something I can truly be proud of.

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1.0 INTRODUCTION

Gardens have been incorporated into elementary school education since the 1800s and are gaining popularity once again. The popularity of school gardens stems from recent trends toward going green, using sustainable agriculture, eating locally grown food and improving the nutrition of youth. The 2010 Dietary Guidelines put out by the USDA and Department of Health and Human Services (DHHS) emphasizes eating a variety of fruits and vegetables and filling half of your plate with fruits and vegetables (CDC, 2011). The 2010 Dietary Guidelines seek to promote health, reduce the risk of chronic disease and reduce the prevalence of overweight and obesity in the United States, specifically through improving eating habits (CDC, 2011). Today, one in seven children aged 6-17 years old is obese (Samuels, Craypo, Boyle, Crawford, Yancey, & Flores, 2010). There is also a health disparity in the incidence of overweight and obesity among populations of low socioeconomic status as compared to more advantaged populations of students (CDC, 2011). To help decrease the high rates of childhood obesity and improve the consumption of fruits and vegetables, interventions are being implemented at the elementary school level (Armstrong, 2000; Blair, 2009; Ozer, 2007). In elementary school, youth are most susceptible to the influences of garden programs, making this age a good time to intervene (Blair, 2009; Ozer, 2007). Research has shown that school garden programs can be utilized as a vehicle for improving the health and well being of youth (Armstrong, 2000; Blair, 2009; Ozer, 2007; Peterson & Fox, 2007).

In addition to increasing nutrition and physical activity, school gardens serve multiple purposes and provide numerous benefits to elementary school systems and students. The purposes of school gardens include increasing nutrition knowledge by providing experiential learning about fresh produce, and providing a green space for youth to engage in physical activity such as planting, weeding, and digging in the garden. School gardens are also used to improve academic performance by enhancing classroom concepts and to develop social, leadership, and problem solving skills by working on tasks with other classmates (Armstrong, 2000; Blair, 2009; Ozer, 2007).

School gardens provide a hands-on learning experience in a number of academic subjects. For instance, gardens have been incorporated into math, science, environmental studies, and nutrition curricula. Students gain an appreciation for the environment not obtainable in a classroom setting (Blair, 2009; Pigg, Waliczek & Zajicek, 2006). They participate in garden activities such as planting and harvesting vegetables, watering, seed dispersal, weeding, shoveling, and composting (Morris & Zidenberg-Cherr, 2002). Incorporating gardens into the learning environments of elementary school children provides a unique opportunity for youth that they may not have outside of school. A high percentage of youth are growing up in more urban areas where such experiences are lacking (Peterson & Kay, 2007; Waliczek, Bradley, & Zajicek, 2001). Notwithstanding the benefits, implementing and sustaining gardens can be challenging and these programs face a number of barriers including funding, obtaining instructors with gardening experience, curriculum materials development, time, and parent and community involvement. Currently, much of the burden for school gardens is placed on teachers who must both instruct students and manage the gardens. To improve the success of gardens at

the elementary school level these barriers need to be reduced or eliminated (Eames-Sheavly, Lekies, Macdonald & Wong, 2007; Ozer, 2007).

The overall goal of this thesis is to review and synthesize the literature on school garden programs as a vehicle for promoting youth mental and physical health, and academic performance in elementary schools across the United States. To this end, the following research questions will be addressed: 1) What purposes do school garden programs serve in elementary schools? 2) Have school gardens been successful in achieving their stated goals? 3) What factors account for school garden program success, especially in schools serving populations of low versus non-low SES? Finally, recommendations for improving school garden programs in order to increase their sustainability are provided.

2.0 BACKGROUND

There is a growing movement in the United States to go green. This includes greening schoolyards and developing gardens. This go green movement has encouraged much enthusiasm for the use of gardens as a learning tool to promote the healthy development of youth (Armstrong, 2000). School garden programs are growing in popularity especially at the elementary school level. In the last twenty years, the use of school gardens for learning and healthy development has become a national movement (Blair, 2009). And, looking forward, Healthy People 2020 is focused on reducing inappropriate weight gain and increasing fruit and vegetable intake in early and middle childhood, as well increasing the quality, availability, and effectiveness of educational and community-based programs for health promotion (Healthy People, 2020). School garden programs are potentially able to address both of these objectives.

2.1 HISTORY OF SCHOOL GARDENS

Gardening was originally introduced into schools in the United States in the late 1800s as aesthetically pleasing areas for youth to learn about science and agriculture and gain vocational skills. The U.S. school garden movement was modeled on the European garden programs. During World War I and II, school gardens were identified as a good solution to the current national security issues of the day. That is, the war was threatening the food supply and even

Europe became dependent on food grown in the United States. To increase fruit and vegetable consumption and improve the health of the U.S. population, the U.S. Garden Army enlisted “soldiers of the soil” to grow foods at schools, known as Victory Gardens. The notion that “food will win the war” became very popular and 40% of all fruits and vegetables consumed in the U.S. were grown in school gardens (Urban Sprouts, 2009). During the Progressive Era (1890-1920), school gardens became a national craze with estimates of 75,000 school gardens in existence by 1906 (US Department of Agriculture, 2011). However, by the 1950s, academic priorities had changed and school gardens were no longer seen as an important part of the curriculum (Blair, 2009).

In the 1990s, school gardens once again began to gain popularity in the U.S. Some states, most notably California enacted legislation to encourage school gardening. Since 1995, California has had the *Garden in Every School* initiative in place. This initiative has resulted in 57% (n=3000) of elementary schools in California with instructional gardens or some variations of plantings (California Department of Education; Blair, 2009; Bradley, 2000). California also has *The Edible Schoolyard* program, which was founded in 1995 by Alice Waters, author and chef. *The Edible Schoolyard* program began in Berkeley, California in an elementary school as a small, one-acre garden and kitchen classroom. The program has now developed into a much larger program with affiliates across the country (The Edible Schoolyard, 2010). The northern states have been slower to develop garden programs, primarily due to climate restrictions. However, much progress has been made in terms of implementing garden programs for youth development. In the state of New York, there are more than 200 elementary schools that utilize a state garden curriculum (Blair, 2009). *The Edible Schoolyard* program has also reached the northern areas of the country with a number of affiliate programs, specifically in New York and

Pittsburgh. In Pittsburgh, there are four elementary schools modeled on *The Edible Schoolyard* program developed by Alice Waters. The mission of these gardens is to change the eating habits of not only the students but also their families and community members by increasing curiosity about fresh fruits and vegetables grown in and then prepared from the gardens. The curriculum for these schools includes garden activities that have the potential to enhance children's' eating habits, physical activity and academic achievement. These school gardens have resulted from a successful collaboration between teachers, community members, families, students, and Grow Pittsburgh (Grow Pittsburgh, 2011).

2.2 OVERVIEW OF SCHOOL GARDEN PROGRAMS

School gardens are a form of community gardens that promote social networks, relationships, and connectedness in the school setting. The current increase in the number of school garden programs being implemented is partly a result of overweight and obesity rates and low consumption of fruits and vegetables by youth in the United States. Gardens help promote physical activity and healthy eating among youth which helps to reduce the number of children who are overweight or obese (Ozer, 2007). In 2007-2008, 12% of children and adolescents ages 2-19 had a BMI score equal or above the 97th percentile on a standard growth chart. Almost 17% of this age group were equal or above the 95th percentile, and 32% had BMI scores equal or above the 85th percentile (Ogden, Carroll, Curtin, Lamb & Flegal, 2010). The high rates of childhood obesity today are due in large part to unhealthy eating behaviors such as a very low intake of fresh produce and a very high intake of fats and total calories (CDC, 2011). By 2009, less than 10% of youth in the United States between the ages of 4-13 met the 5 A Day program

recommendations, consuming five fruits or vegetables each day (Heim, Stang & Ireland, 2009). The National 5 A Day program was replaced in 2007 by the new public health initiative, “Fruits & Veggies – More Matters”. This initiative reflects new dietary recommendations focusing on eating more than five fruits and vegetables each day (CDC, 2011).

Eating more fruits and vegetables promotes health and reduces the risk of chronic disease (Heim, Stang & Ireland, 2009). Therefore, garden programs can be used as a health promotion technique to promote healthy eating and more physical activity, which can mitigate obesity rates and possible long-term consequences, such as cardiovascular disease, and diabetes (Lautenschlager & Smith, 2007; Morris & Zidenberg-Cherr, 2002). School gardens provide the opportunity for children to broaden their understanding of where food comes from and expanding their taste for new types of foods. A school garden nutrition curriculum includes: identification of food groups, understanding the body’s energy and nutritional needs, how to read a nutritional label, identify portion sizes, and understanding the benefits of eating unprocessed foods (Blair, 2009; Ozer, 2007).

There are other goals of school gardens beyond health benefits, such as academic and lifestyle benefits. School gardens have the potential to go beyond just strengthening the health behaviors of youth but also to strengthen the entire school environment (Klemmer, Waliczek & Zajicek, 2005). Garden programs vary in their scope of implementation, participation intensity, and utilization of various gardening techniques. In terms of academics, gardens have typically been incorporated into science lessons, since gardens can provide environmental education outside of the classroom (Castro, 2010). However, teachers are beginning to utilize gardens for other academic subject areas as well. Thus far, gardens have been incorporated into math, language arts, nutrition, environmental science, and general science curricula (Thorp, 2003). In

math for instance, students use gardens to identify three-dimensional objects and measure the area under construction. And in language arts, journals can be kept about the garden. Readings can also incorporate various plants, and nature in general, that the students are being exposed to in the garden (Castro, 2010).

Beyond the academic and health benefits of school gardens, there are also lifestyle benefits that include the development of interpersonal relationships, social skills, teamwork, leadership, and problem solving skills (Thorp, 2003). Interpersonal relationships and social skills are built in the garden when students interact to complete tasks and talk about their experiences with other students and teachers. Teamwork is achieved by working together to achieve common goals in the garden. Leadership and problem solving skills are developed when students are challenged by where and how to plant (Robinson & Zajicek, 2005). The use of school gardens for lifestyle purposes is not as common, but this is beginning to change (Ozer, 2007).

2.3 FACTORS CONTRIBUTING TO SCHOOL GARDEN SUCCESS

School garden programs are recommended by the CDC to be utilized in obesity prevention and nutrition education programs. In order to implement evidence-based programs like school gardens, Fixsen et al. (2005) have recommended the use of the core implementation components, which are described below. These components thus far have not been utilized in implementing school gardens. The following are the core components of implementation: staff selection, pre-service and in-service training, ongoing consultation and coaching, staff and program evaluation,

facilitative administrative support, and systems interventions (Fixsen, Naoom, Blase, Friedman & Wallace, 2005). With the use of the core components of implementation in place, evidence-based school garden programs can contribute to school wellness policies that are currently federally mandated (Ratcliffe et al., 2009).

A major contributing factor to garden success is the location. Elementary schools provide a unique opportunity to reach a large number of youth five days a week, six to seven hours a day, for the majority of a year (Peterson & Fox, 2007). Intervening at the elementary school level is important since children develop many of their leadership and life skills in the early years of their lives. Research has shown that well designed programs implemented in schools can be very effective in increasing physical activity and healthful eating (Wechsler, McKenna, Lee & Dietz, 2004). There are already policies in place at the national level to improve nutrition of youth in elementary schools, such as the National School Lunch Program and School Breakfast Program. Policymakers are recognizing the important role schools play in overall healthy youth development (Peterson & Fox, 2007).

Gardens have also been successful because of the experiential learning techniques utilized. Incorporating gardens into the academic curriculum reinforces information provided in classroom instruction. Gardens provide students a hands-on learning experience that is tangible and meaningful, resulting in a better understanding of certain concepts such as science, environmental science, and nutrition (Bradley, 2000). Blair (2009) explains, “Hands on learning is a key component of experiential education since it emphasizes the development of lifelong learning skills, problem solving and critical thinking”. Hands-on learning techniques used in garden programs can include planting, weeding, harvesting and food preparation, all which have been found to provide a personal connection with food (Heim et al 2009). Overall, school

gardens are a relatively inexpensive health promotion tool that support positive youth development, and promote academic achievement and good health (Ratcliffe et al 2009).

3.0 METHODOLOGY

3.1 DATA COLLECTION

The data for this study came from a review of peer-reviewed journal articles that were identified using PubMed, Scopus, and Google Scholar search engines. The University of Pittsburgh health sciences library system was utilized for the retrieval of full-text journal articles. The following search terms were used: 1) school gardens, low socioeconomic status (SES), elementary school; 2) students, youth, minority; 3) academic achievements, nutrition education, physical activity, science, interpersonal relationships; 4) overweight and/or obesity prevention; and 5) impacts, benefits, barriers and interventions of garden programs. First, the search terms focused on nutrition education, elementary schools, school gardens, and the potential benefits. Next, the individual searches were linked together to produce more specific results. The reference sections of each article identified were then searched for relevant articles for this review. The literature search identified studies about the various goals of school garden programs and their impacts on elementary school youth.

The inclusion criteria for relevant articles for this review were studies of school garden programs in the United States that were implemented in elementary schools, during school hours. Articles were included from 2001 to present. Studies focusing on community gardens were excluded from this review. Studies were also excluded if access to the journal was denied. After

applying the inclusion criteria to all journal articles, 16 articles were identified that are discussed in this literature review.

3.2 DEFINITION OF TERMS

The term *youth*, as defined by the CDC, refers to children ages 6-11 years old. Adolescents are described as children ages 12-17 years old. Adolescents were not included in this review, but one article included in the review did discuss the affects of school garden on children over 12 years old as well. Only the youth age group was included since the focus is on elementary school gardens.

Garden based learning is defined in the literature as any instructional strategy that utilizes a garden as a teaching tool. A school garden, for this review, is defined as any outdoor learning classroom that has the goal of improving academic, lifestyle changes, or health benefits of youth. The garden can be in the ground or in a raised bed, and can grow flowers, vegetables, or both.

Overweight and obesity as defined by CDC guidelines, is determined by an individual's body mass index (BMI). BMI is calculated for children and adolescents, ages 12-19, using their height and weight. BMI is both age- and sex-specific and is compared on standard growth charts. Overweight is a BMI score between the 85th and 95th percentile, obese is a BMI score equal or greater than the 95th percentile.

A *low socioeconomic status (SES) school* is considered an elementary school with 50% or more of the student body eligible for free or reduced lunches. Elementary schools with less than 50% of students who are eligible for these programs are considered non-low SES schools.

3.3 LIMITATIONS AND PROBLEMS ENCOUNTERED

There is a lack of evidenced based research in the area of school garden programs. To account for this, I expanded my literature search to include all purposes of school gardens and not just health benefits. The review was also expanded to include both lower and upper grades in elementary schools to obtain more research studies. Evaluations of garden programs operating in schools serving low SES populations have received very little attention. Only three articles were found which addressed this topic. Outside the United States, specifically in England and Australia, much more research has been done. However, I decided to exclude the programs in other countries to focus on the use of gardens as a health promotion tool in the United States only.

4.0 FINDINGS

4.1 PURPOSES OF ELEMENTARY SCHOOL GARDEN PROGRAMS

4.1.1 Academic

A major goal of school garden programs is to improve academic achievement and to enhance concepts learned in the classroom. Math, science, language arts, environmental science, and nutrition subject areas are usually the focus for instruction. From the literature searched, four studies were found that evaluated the effects of school gardens on academic performance. Gardens were used to enhance science learning in all four studies and all studies found improved attitudes toward science. Three of these four evaluation studies found significant differences in academic performance in youth after their participation in a garden program.

Dirks and Orvis (2005) evaluated the Junior Master Gardener (JMG) program in Indiana to assess its use in classroom learning. JMG is a ten to twelve week long youth gardening program that focuses on enhancing science and environmental science education. In total, eleven schools in Indiana were included in the study, and the focus was on the third grade level. The classrooms were very diverse with students from rural, urban, small town and large town settings. There were few minorities represented, only six African American, five Asian, six Hispanic, and two Native Americans. All students completed Likert-scale pre and post tests to

assess their short-term knowledge gain and attitudinal changes related to general gardening, the environment and science. The effectiveness of JMG was evaluated using a survey of all open-ended questions completed by teachers and students at the end of the study, and through at least one classroom observation per class. Overall, Dirks and Orvis (2005) found a significant positive change in attitudes and knowledge of the environment, science, and gardening after participating in JMG. Beyond the scope of the assessment, teachers reported incorporating JMG curriculum into other academic subject areas, such as math and language arts due to its success in science and environmental science lessons (Dirks & Orvis, 2005).

Another study that assessed the impact of school gardens on academic achievement was conducted by Skelly and Bradley (2007). This study examined the effects of garden programs on students' attitudes toward science and environmental studies and academic responsibility. Participants included 28 teachers and 427 third grade students. There was a lack of diversity in this study and the majority of students were white. Most of the schools (85%) were located in more urban, residential areas. Since many of the elementary school teachers used gardens for science, the students' attitudes toward science and the environment were examined using a pre and post evaluation, as Dirks and Orvis (2005) did. This study differed from the other three studies reviewed and also determined variation of garden programs, so observations, teacher interviews, and teacher surveys were also completed. Unlike the other three studies, garden programs were divided into three intensity levels (low, medium, high) based on the number of garden activities students participated in, length of sustainment of the garden program at the schools and the amount of time the garden was utilized as an academic tool. The researchers found that students participating in a medium-intensity garden program had positive attitudes toward science compared to students participating in low or high-intensity garden programs.

Overall, the study findings were consistent with results of previous research, which showed that school garden program participation fostered student responsibility and facilitated the teaching of science by providing students with tangible experience and practice (Skelly & Bradley, 2007).

Along with science and environmental studies, gardens have also been utilized for math lessons. Pigg, Waliczek and Zajicek (2006) looked at the effects of school garden programs on third, fourth, and fifth grade students' math and science achievement. A total of 196 elementary students from McAuliffe Elementary School in Texas participated in the study. This school was chosen since all teachers utilizing a garden were recently trained to use the garden curriculum developed by the Texas Agriculture Extension Service (TAES). Students in participating classes were divided into control and experimental groups. Experimental groups participated in the gardening program in addition to math and science classroom learning. Students in the control groups did not participate in gardening, and only had traditional math and science teaching methods. Pre and post math and science achievement tests were administered to all students. The study did not find significant difference in science achievement between experimental and control groups in the three grades. However, when grade level was compared (third, fourth, fifth) for science achievement, fourth graders achieved higher scores after participating in the garden program compared to students that only had traditional science lessons. Fifth grade students overall had the lowest scores for science, and math, when participating in the garden program. Regarding math achievement across the three grade levels, students in the control group scored 4.13 points higher than the experimental group students. Therefore, Pigg, Waliczek and Zajicek (2006) concluded that traditional math lessons might be more effective than teaching math concepts utilizing a garden curriculum. A garden curriculum with a focus on math, not just utilized in math lessons, would be needed to improve math achievement scores.

Overall, the garden was a useful tool for enhancing science education for students at the fourth grade level, correlating with prior research (Dirks & Orvis, 2005; Pigg, Waliczek & Zajicek, 2006; Skelly & Bradley, 2007).

Although the majority of research has focused on evaluating the effects of school garden programs on the academic achievement of students in elementary school, Graham and Zidenberg-Cherr (2005) examined how teachers in California schools determine their uses of garden programs for academic instruction and how effective the programs have been. This is the only study reviewed that examined low socioeconomic status (SES), as well as non-low SES elementary schools. Schools were considered low SES if “more than 50% of students were eligible for free or reduced-priced lunches” (Graham & Zidenberg-Cherr, 2005). Fourth grade teachers at schools with gardens were sent a questionnaire regarding the garden curriculum, 45% of responding teachers were from low SES schools. Low SES schools did not have a significant difference on garden status or use in the participating elementary schools of California. The majority of teacher respondents (68%) used the garden to enhance academic instruction; science (65%), nutrition (47%), environmental science (43%), language arts (42%), and math (40%). Overall, teachers commented on how well gardens can be utilized to tie in certain subject areas and make them more interactive. In terms of garden effectiveness on enhancing students’ academic skills, teachers felt that gardens were moderately to very effective at enhancing science skills. They also thought gardens were somewhat to very effective at enhancing overall academic performance. Overall, California fourth grade teachers found school gardens to be an effective tool in enhancing academic instruction in science, nutrition, environmental science, language arts, and math (Graham & Zidenberg-Cherr, 2005).

These findings support the hypothesis that school garden program participation improves academic achievement, especially among third and fourth graders (Dirks & Orvis, 2005; Graham & Zidenberg-Cherr, 2005; Pigg, Waliczek & Zajicek, 2006; Skelly & Bradley, 2007). Positive attitudes and higher academic achievement were found among students participating in a garden program in the following subject areas: environmental studies, science, nutrition, and language arts. Only one study was found that evaluated school garden programs used to enhance academic learning in areas of low SES. The results showed that school gardens had a positive effect on students of low and non-low SES (Graham & Zidenberg-Cherr, 2005). In sum, it is evident that garden programs can improve academic achievement and enhance the chance of children further enjoying academic learning (Dirks & Orvis 2005; Graham & Zidenberg-Cherr, 2005; Pigg, Waliczek & Zajicek, 2006; Skelly & Bradley, 2007).

4.1.2 Lifestyle

A second goal of school garden programs is to enhance interpersonal skills, leadership abilities, teamwork, motivation, and problem solving skills of youth. Programs with these types of purposes have received less attention in the literature and only two studies were found that address these goals. Waliczek, Bradley and Zajicek (2001) assessed the effectiveness of the Project GREEN school garden program on children's interpersonal relationships and attitudes towards school. Students were included from second to eighth grade from 7 schools in Texas and Kansas, but only results for youth aged 6-11 years old are included in this review since the focus is at the elementary school level. Participating students were either in the experimental group, participating in Project GREEN, or in a control group, not participating in garden

activities. All students completed a pre and posttest in January and May, at the completion of the garden program. These questionnaires consisted of true or false statements regarding interpersonal relationships and attitudes toward school.

Overall, there was no significant difference in interpersonal relationships between students when comparing the experimental and control groups. However, when comparing grade level, students of higher grades showed a significant difference in interpersonal relationships after participating in the garden. Students in lower grades of elementary school worked in more supervised groups in the garden, and resulted in no difference in interpersonal relationships after participating in the garden program. The researchers also found that schools that provided students with more individual participation in garden activities resulted in more positive attitudes toward school compared to other schools in the study. There was also a significant difference in positive attitudes toward school when comparing gender of the experimental group. After participating in the garden program, females in the experimental group had more positive attitudes toward school compared to males (Waliczek, Bradley & Zajicek, 2001).

The second study that examined interpersonal relationships among students participating in a school garden program was Castro (2010). Castro (2010) studied a garden program in a low SES school to determine the effects of the garden on first grade students. The garden was used by teachers to improve motivation and interpersonal relationships of students. The study gathered data through interviews with first grade teachers and groups of students from three first grade classrooms in Southern Louisiana. The garden was completely under the control of the students, which gave them a sense of ownership and control. From the interviews with teachers and students, Castro (2010) found that the garden provided a bonding experience between students, improving their interpersonal relationships. Also, the students were very protective of

the garden and were excited about all the gardening experiences. Overall, the school garden improved interpersonal relationships among the first grade students and increased their motivation of garden use throughout the academic curriculum (Castro, 2010).

4.1.3 Health Benefits

Improving fruit and vegetable consumption, nutrition knowledge, and increasing physical activity are the health benefit goals of school garden programs in elementary schools. In total, five studies were reviewed that evaluated the effects of school gardens on health. Three of the studies (Lautenschlager & Smith, 2008; Morris, Neustadter, & Zidenberg-Cherr, 2001; Morris & Zidenberg-Cherr, 2002) assessed the effectiveness of garden education on nutrition knowledge and all found a significant increase in nutrition knowledge from pre to post evaluations. Two studies also evaluated gardens effects on fruit and vegetable consumption, and both studies found a significant increase in fruit and vegetable consumption per day. The youth's willingness to taste and preference for vegetables was also evaluated in three of the studies and all three studies found significant results.

The first study, Morris, Neustadter and Zidenberg-Cherr (2001), assessed the effectiveness of school gardens on improving nutrition and the dietary patterns of first grade children in two elementary schools in California. One of the schools had a garden program; the other school did not have a garden program. Pre and post student interviews were conducted to determine the students' knowledge and attitudes toward fruits and vegetables. At the school with a garden, nutrition lessons developed by each teacher were incorporated into the classroom learning throughout the entire school year. This school also planted vegetables in the garden, and prepared various dishes with them once harvested. Students at the elementary school

utilizing a garden had a significantly improved ability to visually identify food groups (fruit, grain, vegetable, and dairy) compared to the students in the control group. On the posttest, these students were also more likely to taste the vegetables grown in the garden, which included spinach, carrots, peas, and broccoli. Overall, the study found that it is feasible to incorporate a garden program at the elementary school level and use it as an effective tool to improve knowledge of, and willingness to taste, fruits and vegetables grown in the garden (Morris, Neustadter & Zidenberg-Cherr, 2001).

Heim, Stang, and Ireland (2009) evaluated the Delicious and Nutritious Garden program's effectiveness at increasing preference for, home availability of, exposure to, and asking behavior for fruits and vegetables of elementary school aged children. The program was a 12-week garden program for fourth to sixth graders and was lead by a Master Gardener with 24 years experience. However, training was provided to all other participating teachers. Through the program, children learned how to plant, weed, observe, and harvest plants. Every week the children sampled various vegetables that were being grown in the garden, and developed snacks with the fresh produce. The children were given cookbooks and were asked to share their experiences with family and friends outside of the program. A goal of the program was for the children "to act as agents of change" and to ask for the fruits and vegetables at home (Heim, Stang & Ireland, 2009). Pre and post evaluations were completed that included a survey of fruit and vegetable exposure, preferences, self-efficacy, asking behavior, and at home availability. Overall, the *Delicious and Nutritious Garden* program was very well accepted by the children (97.8%). The improvements in the program that the children suggested were spending more time in the garden, planting more vegetables, and including more fruits. The study found that the children had a significant increase in willingness to taste and preference for vegetables from the

garden, especially types they had never tried before compared to baseline. However, the study did not have a control group and only fourth through sixth graders were included (Heim, Stang & Ireland, 2009).

Morris and Zidenberg-Cherr (2002) studied the effectiveness of a garden-enhanced nutrition program on vegetable preference and nutrition knowledge of fourth grade students. Three elementary schools were included in the study, and were randomly assigned to participate in the program (1 control, 1 nutrition education + garden, 1 nutrition education - garden). In total, nine classrooms (3 from each school) participated in the study. The program focused on combining nine nutrition lessons with gardening techniques. The lessons included: plant parts, nutrients, Food Guide Pyramid, serving sizes, food labels, physical activity, goal setting, consumerism, and snack preparation. Gardening components included: planting seeds, weeding, fertilizing, seed dispersal, butterflies, and harvesting plants. An investigator taught the nutrition lessons every other week for seventeen weeks. To evaluate the effectiveness of the program, all students completed a vegetable preference survey and nutrition knowledge questionnaire. Nutrition knowledge was significantly higher for students at the sites with nutrition lessons, compared to the control site with no lessons. The results were maintained six months after the program, suggesting that nutrition knowledge improvements will have a lasting effect. Students' preferences for vegetables were also significantly increased. Overall, the study found that garden-enhanced nutrition lessons are an effective health promotion tool to enhance nutrition knowledge and vegetable preference (Morris & Zidenberg-Cherr, 2002).

Lautenschlager and Smith (2008) studied the effectiveness of the Youth Farm and Market Project on inner city youth's knowledge of nutrition. The program runs for ten weeks long has been used since 1994 at three locations, where youth are taught concepts through "hands on"

learning techniques in a garden. Pre and post-test surveys and 24 hour recall of food consumption was evaluated by all participating students to determine how effective the program is on improving nutrition knowledge. For males, the program resulted in a significant increase in nutrition knowledge from the pre to post survey. There was also a significant increase in fruit and vegetable consumption after the program. However, for females, there was no significant increase in nutrition knowledge found after participating in the program. There was also no increase in the consumption of fruits and vegetables from the youth's 24 recall. Females had higher scores regarding nutrition knowledge prior to the program, which may account for the insignificant results of the post survey. Overall, the study found modest changes in nutrition knowledge and fruit and vegetable consumption (Lautenschlager & Smith, 2008).

McAleese and Rankin (2007) also measured the effect of school garden education on fruit and vegetable consumption. Students in this study were older than in previous studies, utilizing sixth grade students at three schools in Idaho. From the three schools, one was the control (no school garden), one school had nutrition lessons without a garden, and the third school used a garden for nutrition lessons. Like the Lautenschlager and Smith (2008) study, 24-hour recall of food consumption was recorded for all participants in addition to the twelve-week intervention.

All teachers were trained prior to the start of the intervention and provided a curriculum with all materials, *Nutrition in the Garden*, which provided all lessons incorporating a garden into nutrition lessons. The gardening activities included: planting, watering, harvesting, weeding, cooking classes, salsa making workshops, "add a veggie to lunch", and herb drying. The researchers found that the garden program significantly increased the fruit and vegetable consumption among sixth graders. This study did not find any differences in fruit and vegetable

consumption, and nutrient intake based on sex or age. Those students who participated in the nutrition education lessons with garden activities showed an increase in fruit and vegetable intake compared to students at the control school and the students participating in the nutrition lessons without a garden. The number of fruits and vegetables consumed about doubled from 1.93 to 4.50 servings of fruits and vegetables per day for the group of students participating in the garden activities. The recommended serving is two to five fruits and vegetables per day, dependent on age, gender, and activity level, so this result is within the recommended level.

Table 1 Literature reviewed for the purposes and goals of school garden programs

Authors	School Garden Purpose	Aim of Study	Demographics	Methods	Results
Castro (2010)	Lifestyle (interpersonal relationships and motivation)	Evaluate the effects of a garden program on the interpersonal relationship of students in a low SES school	1 st grade students Low SES Southern Louisiana	Interviews with students and teachers of three first grade classrooms	School garden improved interpersonal relationships among first grade students and increase their motivation.
Dirks & Orvis (2005)	Academic (science and environmental science)	Evaluate the Junior Master Gardener (JMG) program in a formal classroom setting	3 rd grade students (average age 8.7) 139 females/136 males not diverse sample Texas	Pre and post test Likert-type survey of 10-12 week garden program	Significant positive change in knowledge and attitude scores after participating in the JMG program.
Graham & Zidenberg-Cherr (2005)	Academic (general: science, language arts, environment, nutrition, math)	Assess teachers' use of gardens for instruction and the effect on students	4 th grade teachers Low and non-low SES schools in California	Surveys and questionnaires completed by teachers regarding garden curriculum, academic use, student achievements, and barriers	Teachers found gardens to be an effective tool at improving academic achievement.
Heim, Stang & Ireland (2009)	Health benefits (physical activity and nutrition)	Evaluate the <i>Delicious and Nutritious Garden</i> effects on fruit and vegetable exposure, preference, self-efficacy, asking behavior, and home availability.	4 th , 5 th & 6 th grade students Minnesota	Pre and post evaluation surveys No control group	Program was well accepted. Significant increase in willingness to taste and preference for vegetables.
Lautenschlager & Smith (2008)	Health benefits (nutrition)	Evaluate the Youth Farm and Market Project (10 wk) effects on nutrition knowledge and dietary behaviors	Ages 8-15 Inner city youth -1/3 African American -1/3 White -1/3 Hispanic and Hmong Minnesota	Pre and post test surveys; 24-hour food recall workbooks No control group	Significant increase in nutrition knowledge and fruit and vegetable consumption for males only; overall modest increase in both for males and females in nutrition knowledge and fruit and vegetable consumption.

Table 1 Continued

Authors	School Garden Purpose	Aim of Study	Demographics	Methods	Results
McAleese & Rankin (2007)	Health benefits (nutrition)	Measure effects of school garden education on fruit and vegetable consumption	6 th grade (ages 10-13) Idaho	Control group + 2 exp. Groups; 12 weeks + 24-hour food recall; Pre and post tests	Significant increase in fruit and vegetable consumption (from 1.93 to 4.50 servings per day)
Morris, Neustadter & Zidenberg-Cherr (2001)	Health benefits (nutrition)	Assess the feasibility of a garden enhanced nutrition education program to improve dietary habits and nutrition knowledge	1 st grade students California	Pre and post evaluation questionnaires	Incorporating a garden to improve nutrition knowledge at the elementary school level is feasible and an effective tool to improve knowledge of and willingness to taste fruits and vegetables.
Morris & Zidenberg-Cherr (2002)	Health benefits (nutrition)	Evaluate the effectiveness of garden-enhanced nutrition program on nutrition knowledge and vegetable preference	4 th grade students (ages 9-11); 25% of students qualified for free and reduced lunches California	Quasi-experimental group pre and post test vegetable preference survey and nutrition knowledge questionnaire	Significant increase in vegetable preference and nutrition knowledge in school with garden vs. school without a garden.
Pigg, Waliczek & Zajicek (2006)	Academic (math and science)	Effects of a garden program on math and science achievements	3 rd , 4 th & 5 th grade students Texas	Experimental and control groups	No significant difference in math and science achievement for all grades overall; 4 th graders achieved higher achievement scores post gardening than other grades
Skelly & Bradley (2007)	Academic (science and environmental studies)	Understand the variation in school garden programs and assess the impact on attitudes toward science and the environment	3 rd grade students Majority of students white and in urban, residential areas in Florida	Student survey of attitudes and academic responsibility	Participation in a medium intensity garden program improved attitudes toward science; positively fostered learning of science and environmental studies
Waliczek, Bradley & Zajicek (2001)	Lifestyle (interpersonal relationships & attitudes toward school)	Determine if the integration of Project GREEN school garden programs positively influenced interpersonal relationships	2 nd -8 th grade students Texas and Kansas	Control and experimental group	Significant difference found in interpersonal relationships comparing grade level of the experimental group; Significant differences found in attitudes toward school comparing gender and schools in the experimental group

4.2 BARRIERS TO SUCCESS AND SUSTAINABILITY

School gardens have been shown to be a useful tool to enhance academic achievement, better health, and improved social, leadership, and interpersonal skills. However, for gardens to continue to be successful and sustained, a number of resources are needed, such as teacher training and availability of curriculum materials, parent and community involvement, and funding. The following chapter discusses facilitators and barriers to school garden program success in elementary schools (Blair, 2009; Dirks & Orvis, 2005; Graham & Zidenberg-Cherr, 2005; Ozer 2007; Pigg, Waliczek & Zajicek, 2006).

4.2.1 Teacher Training and Curriculum Materials

Teachers and principals are essential to the success of school garden programs. Blair (2009) found that teachers often lack interest in garden programs, do not have knowledge of gardening and do not have the necessary time. Much has been written about the lack of teacher preparation for using gardens in academic settings, but very little attention has been focused on recommendations to improve garden sustainability.

When training is provided for teachers, school garden programs have been found to be more successful and sustainable (Dirks & Orvis, 2005; Graham & Zidenberg-Cherr, 2005; Pigg, Waliczek & Zajicek, 2007). The Junior Master Gardener (JMG) program required all teachers to attend training prior to implementing the JMG curriculum. The training provided them with

ample experience working in a garden and incorporating the garden into classroom learning. This training proved beneficial to the JMG program, since there was a significant positive change in knowledge and attitudes toward academic learning (Dirks & Orvis, 2005). The Texas Agriculture Extension Service (TAES) youth gardening curriculum also provided teacher training. Teachers at participating elementary schools in Texas were trained to utilize the garden curriculum prior to implementation. Each teacher taught the curriculum to their individual classroom, as they would any other subject. This training resulted in the successful implementation of the garden programs at these elementary schools (Pigg, Waliczek & Zajicek, 2007). Graham and Zidenberg-Cherr (2005) also found that to include gardens in academic instruction, a major concern of teachers was the need for training. Some of the barriers cited by teachers were their lack of interest in gardening (63%) and lack of experience gardening (61%). Training for teachers is essential to ensure proper instruction of concepts, related not only to academics, but also to nutrition and overall youth health (Graham & Zidenberg-Cherr, 2005).

Another major concern of teachers is the need for curriculum materials, which may be expensive in order to sustain garden programs. The JMG program provided teachers with all the curriculum materials, including lesson plans, research materials, supplies, and procedures. However, teachers were concerned that sustaining the program after the study would require purchasing materials for the curriculum on their own, which would be very expensive (Dirks & Orvis, 2005). McAleese and Rankin (2007) provided training to teachers prior to the start of the intervention. In addition, all the curriculum materials, including lessons and activities were provided for the teachers. This had a positive influence on the results, since the study found the program to be effective at improving fruit and vegetable consumption of youth (McAleese & Rankin, 2007). Garden curriculums also need to be developed for each classroom subject in

elementary school. The teachers in Texas using the TAES curriculum were using gardens to teach math and science lessons; however the math lesson was not successful in the garden. The TAES garden curriculum was not developed for math which may explain why the math lessons were unsuccessful (Pigg, Waliczek & Zajicek, 2007).

All of the studies that were reviewed evaluated garden programs run by the teachers, except for one garden program. Instead, this program was lead by a Master Gardener with past experience gardening. Therefore, not only is training important, but time is also a major barrier to school garden program success since teachers are the program leaders. Skelly and Bradley (2007) included teachers in their evaluation of Florida school garden programs. They asked how long the teachers had been teaching; why they began a school garden program, their experience with gardening, the amount of time spent in the garden, student involvement level, and how the garden was incorporated into the classroom. This was the only study that conducted interviews with the teachers to better understand their background with gardening, and better understand teacher concerns with experience and time (Skelly & Bradley, 2007). Interviewing teachers and including them in program evaluation will incorporate teachers in the planning process of school gardens, and increase sustainability. Blair (2009) also recommends gardening training as a part of teachers' education in order to ensure that all teachers gain the skills and feel prepared to use school gardening as an experiential learning tool.

4.2.2 Parent and Community Involvement

To gain the support of youth to improve their nutrition, and academic achievement, parents need to be invested. Gardens can provide roles for parental involvement that draw on skills that are not utilized in a classroom setting such as trade skills. These skills could include agricultural

knowledge, physical strength, and problem solving skills (Ozer, 2007). Parent involvement has been found to improve academic achievement of youth. And this finding holds true across families of all socioeconomic background and students of all ages (Henderson & Mapp, 2002). However, parents of lower SES are less likely to be involved in school activities and volunteer opportunities due to more financial pressures (Ozer, 2007). To achieve parent involvement, parents could volunteer in the garden, educational materials could be sent home with youth, and homework assignments that need parent support could be used to begin the discussion on healthy food choices.

In the study by Morris, Neustadter and Zidenberg-Cherr (2001), the participating school encouraged parents and community members to be actively involved. Heim, Stang and Ireland (2009) also encouraged parent involvement in the garden program of fourth to sixth graders. The participating children were given recipe books to take home to family members/care givers to encourage the accessibility of fruits and vegetables at home. Parents were encouraged to improve accessibility through weekly newsletters, recipe book, take home activities, and their children's experiences (Heim, Stang & Ireland, 2009). Morris and Zidenberg-Cherr (2002) also found parent involvement through take home newsletters to be an effective method to enhance nutrition education. Nutrition lessons were taught in a garden every other week for seventeen weeks. But on the weeks between, newsletters were sent home to parents and caregivers to reinforce the nutrition lessons and engage family members.

Along with parent involvement, community involvement is important as well. School gardens need to be kept up during the summer months when school is not in session. Community volunteers can help during this time when students are not actively working in the garden to water the plants, weed, and prepare it for the school year (Ozer, 2007). However,

community members can also support garden programs during the school year and in the classroom. The study by Langhout, Rappaport, and Simmons (2002), specifically looked at developing a culturally relevant, ongoing garden program in four classrooms of an elementary school. The goal of the garden program was to build teacher-community relationships and improve collaborations, while also incorporating the garden into the academic curriculum. Community members helped to plant and harvest vegetables in the garden with the students, and were invited to taste food prepared by the students from the garden. Building relationships between schools and community members can bring in community resources to the school, such as funding, time, and materials needed to sustain the garden. At first there was tension between teachers and community members. Teachers were very unsure of inviting community members into their classrooms and taking away from their time for teaching. However, the study found that when community members did come to the school, it was very successful and enjoyed by students, community members, family, and teachers (Langhout, Rappaport & Simmons, 2002).

4.2.3 Funding

In 2007, the Institute of Medicine recommended utilizing school gardens as a tool to enhance physical activity and healthful eating, and suggested that states increase funding for these programs (Institute of Medicine (IOM), 2007). However, funding has not been increased tremendously, with little or no funding coming from the state or local school districts for most school garden programs. Many school gardens end up relying on donations from community members and organizations for funding (Ozer, 2007). One teacher remark that was common in the Graham and Zidenberg-Cherr (2005) study was, “I wish the state would offer more resources for teacher training to further integrate our garden and the opportunity for hands-on learning in

all subject areas.” Funding enhances the garden materials and curriculum and can also be used to hire a part-time teacher or garden coordinator. Most funding comes from government, philanthropies and local businesses. A number of programs also stated that having a paid, full or part time coordinator to organize and manage the garden program would help sustain the programs and support the teachers (Ozer, 2007).

Azuma, Horan, and Gottlieb (2001) distributed a survey to elementary schools in Los Angeles, California to assess the progress of “A Garden in Every School” California initiative. Of the schools surveyed that never had a garden program, 78.6% reported lack of funding as a barrier. Schools that had a program previously for less than two years also reported lack of funding as a barrier (33.3%). In the survey, over half of the respondents showed an interest in school garden programs and restarting a program if more financial support was available (Azuma, Horan & Gottlieb, 2001).

Table 2 Literature reviewed for the barriers to school garden success

Authors	SES level	Barriers to School Gardens	Recommendations
Azuma, Horan & Gottlieb (2001)	Low & Non-low	Funding	-Lack of funding a major barrier to school gardens -If more financial support available, interest showed for developing a garden program
Blair (2009)	Non-low	Teacher training & curriculum materials	-Lack of interest by teachers, knowledge and time -Recommends the inclusion of gardening training in teachers' education
Dirks & Orvis (2005)	Non-low	Teacher training & curriculum materials	-Teacher training prior to JMG program increased success-teacher training increases garden success
Graham & Zidenberg-Cherr (2005)	Low and non-low	Teacher training & curriculum materials	-Teachers concerned with their lack of interest and experience gardening, and insufficient training for teachers. -Training ensures proper instruction of concepts
Heim, Stang & Ireland (2001)	Non-low	Parent & community involvement	-Encouraged parent involvement through recipe books, newsletters, and take home activities sent home
Langhout, Rappaport & Simmons (2002)	Low and non-low	Parent & community involvement	-Community members and parents actively involved in the upkeep of the school garden
McAleese & Rankin (2007)	Non-low	Teacher training & curriculum materials	-Provided training and all curriculum materials to teachers prior to the implementation of the program.
Morris & Zidenberg-Cherr (2002)	Non-low	Parent & community involvement	-Gained parent involvement through take home newsletters to reinforce nutrition concepts
Morris, Neustadter & Zidenberg-Cherr (2001)	Non-low	Parent & community involvement	-Encouraged parents to be actively involved in the school garden
Ozer (2007)	Low and non-low	Funding, Teacher training, Community involvement, time	-Involve parents and community through volunteer opportunities, and take home assignments
Pigg, Waliczek & Zajicek (2007)	Non-low	Teacher training & curriculum materials	-Trained teachers prior to garden program implementation, resulting in success -Teacher training increases garden success
Skelly & Bradley (2007)	Non-low	Teacher training & curriculum materials	-Performed interviews with teachers leading gardens to understand their background in gardening, and perceived barriers

5.0 DISCUSSION AND RECOMMENDATIONS

5.1 DISCUSSION

5.1.1 Common findings

The questions addressed in this literature review are whether garden programs in elementary schools have been successful in achieving their goals and determining major factors that account for program success and sustainability. From the literature, it is evident that school garden programs have been successful as a vehicle to promote health, academic achievement, and build interpersonal relationships between elementary school students, especially third and fourth graders. Schools provide an excellent opportunity for preventing obesity and should be a focus of obesity prevention and health promotion programs. At the elementary school age, youth spend the majority of their days at school where food availability, physical activity opportunities, education techniques, and student relationships greatly influence students (Birch & Ventura, 2009). School garden programs are found to successfully increase consumption, preference, and knowledge of fruits and vegetables grown in the garden (Heim, Stang & Ireland, 2009; Lautenschlager & Smith, 2008; McAleese & Rankin 2007; Morris, Neustadter & Zidenberg-Cherr; Morris & Zidenberg-Cherr, 2002). Garden programs also increase time spent being

physically active during the school day since students are actively involved in all aspects of the garden including: weeding, planting, watering, and harvesting (Heim, Stang & Ireland, 2009).

School gardens promote social networks, relationship building and connectedness in elementary schools. Providing students time to work independently and in small groups improves interpersonal relationships among elementary school students (Waliczek, Bradley & Zajicek, 2001). School gardens also provide youth an opportunity for hands on and experiential learning that can enhance classroom lessons. Activities in the garden better connect youth to the environment. The utilization of a school garden can also improve the academic achievement of students and enhance lessons in certain subject areas. Specifically, incorporating gardens into science lessons can significantly improve elementary students' academic achievement and attitudes toward science. However, not all youth in elementary school achieve higher grades in science. More research needs to be done to determine the academic benefits of utilizing a garden program for science lessons for all grade levels in elementary school. Using gardens to enhance math lessons has not been as successful as they have in science classes. However, the garden curriculums used in the current research were not developed specifically for math lessons. Therefore, if curriculums are specifically developed to build on math concepts, improvements in math lessons and students' academics could be accomplished. Other than math and science, school gardens have also been successful at enhancing language arts, environmental science, and nutrition lessons for elementary school youth (Dirks & Orvis, 2005; Graham & Zidenberg-Cherr, 2005; Pigg, Waliczek & Zajicek, 2006; Skelly & Bradley, 2007).

5.1.2 Sustaining gardens in low and non-low SES elementary schools

Lower SES communities and minority populations are more vulnerable to becoming overweight. Children in elementary schools in low SES communities eat the majority of their meals at school; they have more opportunities for physical activities, and gaining knowledge related to health and nutrition in the school versus the home setting (Slusser, Cumberland, Browdy, Winham & Neumann, 2005). It has been found that school gardens have been successful in non-low SES schools. However, there is a lack of research on school garden programs in low SES schools in the United States. For this review, only three articles were identified that specifically focused on schools of low SES (>50% of students eligible for free or reduced lunch). When comparing the three studies of gardens in low SES schools to gardens in non-low SES schools, there was no difference between the use and effects of school gardens on elementary students. This suggests that school gardens in low SES schools can be as successful as gardens in non-low SES schools, but more research is needed to make this conclusion.

The findings of the literature reviewed provide some insight into the effectiveness and feasibility of school gardens as a vehicle for health promotion and educational enhancement in both low and non-low SES elementary schools. However, there are a number of barriers to school garden programs that need to be reduced in order for programs to be sustained. Low SES schools are typically characterized as having lower academic scores on standardized tests. In order to justify the amount of time and resources needed for garden programs, benefits of the programs, such as improved academic achievement, would need to be met (Ozer, 2007). The barriers determined from the literature include: funding, improved teacher preparation, time, and community and parent involvement. In low SES schools, parent and community involvement in school related activities may be lower than non-low SES schools. For example, Grow Pittsburgh

has been successful at obtaining family and neighborhood volunteers to tend to Edible Schoolyards at four elementary schools throughout the city. This effort not only gets the community involved, it also helps sustain the garden while the students are not tending to it during the summer. The Edible Schoolyard programs in Pittsburgh have also been successful at increasing students' willingness to taste and preference for fruits and vegetables since preparing produce from the garden is a large aspect of the program (Grow Pittsburgh, 2011).

We know that school garden programs have beneficial effects, however sustaining these programs can be challenging (see Nipper, 2010). Fixsen et al. (2005) provide a model for implementing and sustaining an evidence-based program, like a school garden program. The core components of implementation are: staff selection, pre service and in service training, ongoing consultation and coaching, staff and program evaluation and facilitative administrative support (Fixsen et al., 2005). Using these components can help guide implementation of school garden programs and increase their success in elementary schools.

Staff Selection

Staff selection refers to the hiring of staff within an organization to run a program. This component can sometimes be overlooked due to funding, so staff members, such as teachers, tend to be overworked and burdened with the extra responsibility. For school gardens, attention to obtaining staff and volunteers outside of the school system who can support the program is important when selecting staff. To support teachers, school garden programs may consider hiring a full or part-time garden coordinator, but typically the garden is maintained with the help of volunteers. Numerous programs, such as Grow Pittsburgh, have utilized AmeriCorps members as volunteers. AmeriCorps is a federally funded program open to Americans of all

ages and backgrounds that provides opportunities for individuals to serve in communities across the country (Grow Pittsburgh, 2011). Colleges and universities may also provide volunteers since students are trying to obtain real-life experience and volunteer opportunities to build their resumes.

Pre-Service and In-Service Training

All programs require training to understand the theory behind the program and the skills needed to successfully implement the program. Training the staff prior to implementation of a school garden program has typically been done in research studies, such as through a workshop or classroom session. Since teachers manage and organize the majority of school garden programs, education regarding gardening could be included in all teachers' education prior to becoming an educator. This will provide all teachers a general understanding and knowledge of a garden and ways to utilize it for classroom learning.

However, training also needs to be incorporated throughout a garden program to increase sustainability. An experienced Master Gardener from a local garden organization or farm could help with training sessions. There are also a large number of training resources available online through successful programs, especially since school garden programs are growing in popularity.

Ongoing Consultation and Coaching

Ongoing consultation involves teaching skills while actually on the job. For teachers, having a coach or consultation while coordinating a garden program or activity can alleviate anxiety and provide support, since teachers report having a lack of knowledge of gardening.

This ongoing consultation and coaching can improve the skills of staff and other members involved in gardening.

Program and Staff Evaluation

Evaluations of the staff and program are two more elements that are needed to implement a program. Staff evaluation will assess how well the selection, training, and coaching phases of implementation were carried out and determine if improvements are needed. Program evaluation will actually assess whether the organization (i.e. school) met its goals. With respect to school garden programs, evaluations will measure the student and teacher satisfaction of the garden, resource needs, and garden effects on students' nutrition knowledge, academic achievements and interpersonal relationships. An evaluation could entail a survey, questionnaire or a daily question asking students what they learned while working in the garden that day.

Another method than can be used in addition to an evaluation is Photovoice. Photovoice can be used a feedback tool to assess students knowledge of certain materials and the aspects of gardening that are most widely accepted (Sands, Reed, Harper, & Shar, 2009). During this process, students are provided cameras to take pictures of the garden in response to a question, such as: What is your favorite aspect of gardening at school? and Why is gardening at school important to you? Photovoice can also be used as a more creative means for achieving program funding, participation, and increase sustainability (Sands, Reed, Harper & Shar, 2009).

Systems Intervention

For school garden programs, collaborating with community organizations, school administrators, and local government officials are an essential part of having successful

implementation and sustainability. Working with these partners can help a garden program obtain funding and ensure other organizational needs are met, such as curriculum materials, supplies, and staff. Due to the nation's current economic state and potential educational budget cuts, specifically for the Pennsylvania education system, getting financial support from the government will be a challenge. Therefore, funding may need to come from other entities such as families, community members, local organizations, and grants or scholarships. Fundraising can be utilized to help support a garden program through raffles, donations, PTA support, and annual events that can also actively promote the program in the community.

A number of foundations also provide seedlings to gardens at a very low price. For example, Grow Pittsburgh sells plant seedlings of a wide variety to help support gardening and local sustainable agriculture. Seeds can also be planted to start a garden and are low in price as well. Local garden centers and seed companies may donate these seeds to school garden programs, especially at the end of the summer, when these companies are trying to get rid of excess stock (Grow Pittsburgh, 2011).

5.1.3 School gardens versus community gardens in areas of low SES

From the review of the literature, more community gardens, rather than school gardens are found in low SES areas. Community gardens bring an entire community together and encourage interpersonal relationships (Armstrong, 2000). These gardens also provide access to healthy, fresh produce, provide a space to enjoy nature, and encourage healthy behaviors. In low SES communities, community gardens are frequently cited as one of the only available, affordable sources for fresh fruits and vegetables. In a study by Armstrong (2000), it was found that 46% of community gardens in New York are located in low-income, urban areas with 30% of garden

participants of a minority population. These areas may have a number of vacant lots. Community gardens can make better use of this space by adding an esthetically pleasing element to the community that is also a valuable food resource, and location for building connectedness.

However, after reviewing the literature, school gardens can also incorporate family and community members. Community and parent involvement is a barrier that can be reduced in both low and non-low SES communities by involving them in after school gardening, take home assignments related to gardening, newsletters, and weekly garden updates. Community gardens also lack the educational aspect of gardening and may not specifically target youth. School gardens provide youth the opportunity to not only gain knowledge about nutrition and eating fruits and vegetables, but also incorporate gardening into a learning environment.

5.2 RECOMMENDATIONS

Since there is a lack of research regarding school gardens in low SES schools, researchers need to focus on this area for future studies. This will be beneficial so that more conclusions can be determined regarding the benefits of gardens on low SES youth and increase funding, and garden implementation. There is also a lack of research focusing on the sustainability of school garden programs. Although the major barriers to school gardens have been determined in numerous studies, there have not been specific studies focusing on eliminating these barriers. To address these barriers, I make the following recommendations.

1. Include more volunteers from the community, families and local organizations to alleviate the burden on teachers to organize, maintain, and lead a school garden program.
2. Provide gardening techniques, skills, and tips on how to incorporate gardens into classroom lessons during pre-service education for early education teachers. This will provide teachers background in the field of gardening and utilizing gardens for learning and health promotion.
3. Complete program evaluations, specifically using the Photovoice method, to determine the strengths and weaknesses of a program, and the effectiveness of program goals. For example, evaluate taste preference of fruit and vegetables with more food preparation and monitor food waste in the lunchroom to determine consumption of fruits and vegetables by students.
4. Link community gardens and elementary schools together, specifically in low SES schools and areas. Since community gardens are found in low SES areas, working with schools can help to reach the goals of school gardens. This partnership may also help sustain gardens when funding is lacking.
5. Determine the sustainability of school garden programs in terms of long-term effects. School gardens are found to be effective at achieving their goals. However, it still needs to be determined whether these effects are still seen once the youth leave elementary school to go to middle and high school levels.

6.0 CONCLUSION

Elementary schools provide an ideal location to reach a large number of youth of diverse backgrounds, and SES levels. Therefore, schools present as a prime location to address the epidemic of childhood obesity, in terms of increasing consumption, and knowledge of fruits and vegetables and increasing time spent being physically active. Garden programs can serve as a successful vehicle for health promotion to improve the overall mental and physical health of youth. This review demonstrates that through hands-on learning, gardens can enhance classroom lessons and improve academic achievement and provide youth environmental experiences, such as planting, and harvesting fruits and vegetables that build interpersonal relationships among students, social networks, and team work skills.

Because of the public health concern of childhood obesity and the disproportionate effects on low SES and minority populations, garden programs can be used to enhance obesity prevention programs. Further research is needed to determine the effects, purposes, and success of school gardens in schools with low SES populations. Since the obesity epidemic disproportionately affects areas of low SES, and minority populations, improving on existing programs, and implementing new garden programs in these schools may prove beneficial.

The barriers that school garden programs face can be reduced with increased support of communities, family members, local organizations, and federally funded volunteers (i.e. AmeriCorps). With the support of these entities, school gardens can continue to make an impact

on participating elementary schools, and expand to more elementary schools throughout the United States.

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