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Use of School Gardens in Farm to School Programs

Corinne E. Schaidle

Southern Illinois University Carbondale, cschaid@siu.edu

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USE OF SCHOOL GARDENS IN FARM TO SCHOOL PROGRAMS

by
Corinne Elizabeth Schaidle

B.S., Southern Illinois University, 2009

A Research Paper
Submitted in Partial Fulfillment of the Requirements for the
Master of Science

Department of Plant, Soil and Agricultural Systems
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Approved by:

Dr. Seburn L. Pense, Chair

Amy Boren

Karen Midden

Graduate School

Southern Illinois University Carbondale

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CHAPTER 1

INTRODUCTION

Background

Research has shown that school gardens can positively impact school children in many ways. They improve children's preferences for fruits and vegetables as well as help increase their nutritional knowledge. Morris, J., & Zidenberg-Cherr, S. (2002) found that school gardens enhanced students' nutrition curriculum. At the fourth-grade level this curriculum significantly improved the nutrition knowledge of the students (Morris, J., & Zidenberg-Cherr, S., 2002). The use of the school garden and nutrition curriculum was also shown to have a significant positive effect on the students' preferences for some vegetables (Morris, J., & Zidenberg-Cherr, S., 2002). Graham and Zidenberg-Cherr (2005) found similar results when they studied the use of school gardens as a nutritional tool to promote healthy eating habits. Fourth-grade teachers in California were surveyed about their attitudes towards school gardens, what garden practices they used and what barriers existed that prevented them from effectively using the gardens. Results showed that teachers were using the gardens to not only teach core subjects but nutrition as well (Graham & Zidenberg-Cherr, 2005). It is clear from this past research that school gardens are a great asset to elementary curriculum. The gardens help teachers educate their students about healthy lifestyle choices as well as aid in the teaching of core subjects.

In the past, school gardens have been used to educate students in several different subjects, aid in academic instruction, grow edible produce, and support extracurricular

activities. In recent years, the gardens have been used to teach agriculture, science, nutrition and environmental studies (Graham, Beall, Lussier, McLaughlin, & Zidenberg-Cherr, 2005). A survey of principals in California found that school gardens at high schools were primarily used to teach agricultural studies and science (Graham et al. 2005). Graham et al. (2005) found that the number one use of school gardens was to enhance academic instruction. Principals also reported using school gardens to grow food for consumption and to support extracurricular activities (Graham et al. 2005). Students at schools with gardens get hands on experience that prepare them for jobs they may one day have. The gardens could support many different activities. At the high school level these activities may include FFA, food science classes, Future Community Career Leaders of America (FCCLA), as well as before/after school programs.

Farm to School programs have gained much attention over the past few years. Imas (2004) states that there are almost 400 school districts in 22 states that are currently operating Farm to School programs. Throughout the years many definitions of Farm to School programs have been created. Imas (2004) lists such things as “establishing salad bars” (p. 23), hosting local food days, “bring a farmer into a classroom, creating a school garden and taking field trips” as ways to establish a Farm to School program. No matter what classifies as a Farm to School program, they are being developed in record breaking numbers. Joshi, Azuma, and Feenstra (2008) stated that “farm-to-school programs have the potential to create connections among classrooms, cafeterias, and gardens, involving teachers, students, cafeteria workers, parents, administrators and farmers in activities that support good health, nutrition, agriculture and the local economy” (Joshi, Azuma, & Feenstra, 2008, p. 230.) It was the creation of these connections that was essential in the

formation and upkeep of these programs. Students benefited most from these programs when several groups of people were working in collaboration with each other.

In 2009 the state of Illinois' General Assembly passed legislation that regulates the purchase of food for State agencies and State-owned facilities, as well as for state funded programs (HB 3990, 2009). This legislation was known as the Local Food, Farm, and Jobs Act. HB 3990 (2009) covers facilities for persons with mental health and developmental disabilities, correctional facilities, and public universities as well as public schools, child care facilities, after-school programs, and hospitals. By 2020, all State-owned facilities will be required to purchase 20% of all food and food products from local sources. Also by 2020, state funding programs that spend more than \$25,000 per year on food or food products for their students, residents, or clients, will be encouraged to purchase at least 10% of their food locally (HB 3990, 2009). Several schools and facilities in Illinois will have a hard time reaching these goals and the act has strived to provide assistance to these programs. The goal of this act was to increase the local economy and encourage businesses to buy fresh and local produce. Kalb (2006) stated that farming as an industry is currently facing its greatest decline in ages. This was especially true at the small scale family farming level. These small farms produced fresh foods to be sold locally and they have depended on unreliable, unpredictable, and untimely consumers to purchase their goods. The Local Food, Farms, and Jobs Act sought to provide these small farmers with regular, predictable customers.

As a result of this house bill, and all other implications, it was important to assess the various opportunities and barriers that surround the Farm to School program in

Illinois. It would be important to examine the possible use of school gardens to help public facilities meet the requirements of HB 3990.

Statement of Purpose

This study sought to determine the status of high school gardens. It examined the extent, if any, to which gardens could be used to produce local food, to be used in a Farm to School program. The benefits of school gardens were also reviewed.

Research Questions

This study sought to answer five main questions.

1. What current practices were being used at high school gardens?
2. What were the attitudes associated with the use of school gardens in schools?
3. What were the barriers to having and using a school garden in academic instruction?
4. What were the barriers to having and using a school garden to produce foods that can be used in a Farm to School program?
5. What were the benefits students received when school gardens were incorporated into their curriculum?

Significance of the Problem

Few studies, if any, have been conducted on the state of high school gardens in Illinois. There was a need to understand how these gardens are being used and determine what they could potentially be used for. Most studies that have been conducted assessed school gardens at the elementary level. Targeting this age group to address nutrition

education seemed to be ideal. However, healthy or unhealthy habits were well established for students in high school. The use of school gardens for this age group needed to cover more issues than just the consumption of healthy foods. Research is needed to be done to determine the possible uses of school gardens at the high school level. This research was significant because it helped to determine if school gardens could also be used to produce fresh foods to be sold to schools. The questions answered by this research could lead to many changes in the Farm to School programs.

Farm to School programs in the past have been difficult to start up and even more difficult to sustain. Any research that is conducted on the programs would lead to a better understanding of how they function. Isumi, Rostant, Moss, and Hamm (2006) used results from a survey conducted in Michigan in 2004 to compile data about the use of Farm to School programs. Their survey interviewed food service personal and uncovered many of the difficulties they face when establishing a Farm to School Program (Isumi, Rostant, Moss, & Hamm, 2006). Understanding the barriers that exist in running Farm to School programs allows them to be worked on, developed, and conquered.

From an educational standpoint, this research was very important. Little research has been done at the high school level to determine how school gardens could be used to aid in academic instruction. Many high schools throughout Illinois had classes that were centered on horticulture and agriculture. These two subjects, especially, were closely tied to hands on learning. Previous research has shown teachers how to use the gardens at the elementary level and allowed for garden curriculum to be integrated into everyday learning.

The use of these school gardens could certainly provide many benefits to the students, the schools, and the communities. Before any well established programs are created, research needs to be done to better understand what the program could and would entail.

Limitations and Delimitations

This study faced a limitation in the amount of available resources. Ideally, several case studies would have been used to test the effectiveness of school gardens to grow foods to be used in a Farm to School program. Education of students using the gardens could be observed first hand. Educators would not have to voice their frustrations as they could easily have been observed. However, in Illinois there were very few schools that currently used a school garden to produce fresh foods to sell. Those schools that were producing food were not assessable for this research. Conducting a survey of Illinois schools with gardens would be the next best thing to establish what these school gardens could potentially be used for.

This study was intended to focus solely on the use of high school gardens. These gardens were typically used in conjunction with an FFA program or an agricultural classroom. However, there was not an abundance of possible source material for this study. School gardens were used by many schools to teach children of all levels, but very few studies of high school gardens existed. By focusing on one specific sector of school gardens, a more detailed description could be established from the findings. However, because this specific sector had not been researched a wider range was selected. Schools had several options for obtaining fresh produce to use in a Farm to School program. This

research strived to study only one of these options. It was likely that most school gardens would not have been large enough to provide schools with the needed 10% of local foods, but it was the option that benefited the greatest number of people.

Definition of Terms

When conducting, or interpreting, research it is important to know and understand key words that are used within the research. Within this research there were many definitions that had been disputed over the years. What does local really mean? The following definitions will be applied to the research conducted in this study.

- Local shall be defined as “products grown, processed, packaged, and distributed by Illinois citizens or businesses located wholly within the borders of Illinois” (HB 3390, 2009, p. 1). This was also the working definition for the house bill which was discussed earlier. This was a logical definition to use for this research because it was the definition that schools would have to abide by when purchasing local produce. When researching Farm to School programs it was important to know how the researcher defined these programs. Farm to School in the past had been used to cover a broad range of systems.
- For this study Farm to School programs are defined as programs that “connects schools (K-12) and local farms with the objectives of serving healthy meals in school cafeterias, improving student nutrition, providing agriculture, health and nutrition education opportunities, and supporting local and regional farmers” (Occidental College, 2006, About Us section,

para. 2). This was the definition used by the national Farm to School Program website and it accurately described what Farm to School programs were and did. This research was centered on the use of school gardens; the word garden was associated with many different things.

- For the purpose of this research a garden has been defined as an area used for the production of fruits, vegetables, and/or herbs. This could include plants grown in the ground or in raised beds. Plants that were grown in pots or in greenhouses were also included in this definition. These areas could be located inside the classroom or outdoors. School gardens could also be located off campus, in an area more suited to growing produce.

CHAPTER 2

REVIEW OF THE LITERATURE

The literature review was conducted to gain greater insight into the use of school gardens, cafeteria based fruit and vegetable interventions, and Farm to School programs. The literature review sought to uncover the attitudes surrounding the use of school gardens, the barriers to using gardens in academic instruction, and the benefits of school gardens. The literature review was also conducted to analyze the barriers to using school gardens in Farm to School programs. Overall, the literature presented demonstrates that these three experiences greatly affect the students, teachers, and community members involved in them. Several studies have examined how school gardens affect students' fruit and vegetable consumption and knowledge, science achievement and environmental attitudes. Few studies have directly compared the use of school gardens to the use of cafeteria based interventions and how these programs affect Farm to School programs. Finally, the knowledge and insight gained from the literature are synthesized in light of this study.

A survey of all principals in California was attempted in 2005 to investigate the use of school gardens in academic instruction. An 18 item questionnaire was distributed to 9,805 principals in California, 4,194 questionnaires were completed and returned providing a 43% response rate (Graham, et al., 2005). This study sought to measure three areas pertaining to school gardens: current practices, attitudes, and barriers. Graham et al. (2005) found that the learning outcomes most often studied were science (95%), environmental studies (70%), and nutrition (66%). The age groups studied were predominantly elementary (56%). Current research showed that among published

quantitative and qualitative studies, science achievement, environmental attitude change, nutrition knowledge, and life skills had been most frequently measured. Research in these areas has generally been intended for elementary school children; however some work with high school students has been completed.

Quantitative Assessments of School Gardens

A total of 14 quantitative studies were reviewed for this paper. The studies reviewed used a pretest and posttest design or a simpler posttest only design. Most studies were conducted on third through fifth grade students; although, one small study was conducted with high school students. These studies are summarized in tables 1 through 4, where they were categorized by the specific outcomes researched.

When a criterion of $p < .05$ for significant results was used, eleven of the fourteen studies showed a positive difference in test measures when comparing gardening students and non-gardening students. Three studies (Table 1) were conducted to evaluate the effects of gardens on science achievement scores for third through fifth grade students (Mabie, R., & Baker, M., 1996; Rahm, 2002; Dirks & Orvis, 2005; Klemmer, Waliczek & Zajicek, 2005a; Klemmer, Waliczek, & Zajicek, 2005b; Smith & Motsenbocker, 2005). In all three studies, gardening increased science scores of students.

Table 1

The Use of School Gardens to effect Science Achievement - Quantitative Assessment

Authors, by date published	Objective	Sample and/or Design	Instruments	Results
A. Dirks and K. Orvis (2005)	Determine the impact of the Jr. Master Gardener Program (JMG) on Classroom Science Achievement	277 students from schools in Indiana Pre- and Posttest	Quantitative instrument evaluating attitudes using a Likert scale	Overall Sig. dif. (positive change) in knowledge and attitude scores from pre to post. (p<.0001)
C.D. Klemmer, T.M. Waliczek, and J.M. Zajicek (2005b)	Determine the effectiveness of school gardens in enhancing Science Achievement	647 Students (453 in experimental classes and 194 in control classes) Posttest only	Garden Curriculum and teacher training given to experimental classes Delayed for Control Klemmer Science Achievement test	Science Achievement higher for gardening students (p<.001) 5th grade students showed sig. dif. When compared to the control group (p<.001)
L.L. Smith and C.E. Motsenbocker (2005)	Quantify the effects of a school garden and garden curriculum on the science achievement of fifth grade students	62 fifth grade students in the experimental classes and 57 students in the control classes Pre- and posttest	The Junior Master Gardener handbook Level 1 Horticulture undergrads gardened with students once a week for 14 weeks Klemmer Science Achievement test	Higher Science Achievement in Gardening Students (p<.05)

Five studies (Table 2) were reviewed to evaluate students' knowledge of nutrition and preferences for fruits and vegetables when associated with school gardens (Lineberger, S., & Zajicek, J., 2000; Morris, J., Briggs, M., & Zidenberg-Cherr, S., 2000; Morris, J. L., Neustadter, A., & Zidenberg-Cherr, S., 2001; Morris, J., & Zidenberg-Cherr, S., 2002; McAleese, J. D., & Rankin, L. L., 2007; Impact of a school-based, 2009). Three of the studies were conducted using a control group, a nutrition lesson only group (NE), and a nutrition plus gardening group (NE+G) (Morgan, P., Warren, J., Lubans, D., Saunders, K., Quick, G., & Collins, C., 2010; Morris, J., & Zidenberg-Cherr, S., 2002; Parmer, S., Salisbury-Glennon, J., Shannon, D., & Struempfer, B, 2009). In 2002 Morris and Zidenberg-Cherr found that the NE and the NE+G groups had

significantly greater nutrition knowledge scores than the control groups. They also found that the NE and NE+G groups had significantly greater vegetable preferences over the control group. No significant differences existed between the three groups willingness to taste the vegetables.

Table 2

School Garden Food and Nutrition Outcomes - Quantitative Assessment

Authors, by date published	Objective	Sample and/or Design	Tools/Instruments	Results
S. E. Lineberger and J.M. Zajicek (2000)	Develop a garden-activity guide for teachers Measure attitude change toward fruits and vegetables	111 Texas 3rd-5th grade students (quasi-experimental) No control Group Pre- and Posttest Control-61 4th grade students NL-71 4th grade students NG-81 4th grade students Pre- and Posttest with follow-up	Teachers gardening activity guide Fruit and Vegetable preference questionnaire 24-recall food journals (pre and post) Nutritional knowledge questionnaire Willingness to taste 6 veg. Rated Veg. preference on Likert-type scale 6 month follow-up on preference	Increased veg. preference (p<.05) Increased preference for F&V as snack (p<.01)
J.L. Morris and S. Zidenberg-Cherr (2002)	Develop and test 9 garden-enhanced nutrition lessons	320 6th graders two intervention schools (170 students) One control school (150 students) Quasi-experimental, pre-post panel	Garden based learning sessions for 1hr a week for 4 months Community events Garden veg. frequency questionnaire and Taste Test	Compared to others, NG site preferred more vegetables 6 month follow-up: Ng group retained sig. higher preferences for some vegetables.
M.M. Ratcliffe, K.A. Merrigan, B.L. Rogers, and J.P. Goldberg (2009)	Investigate the impact of participating in a school garden program on student's ability to identify, willingness to try, preference for, and overall consumption of vegetables	6 second-grade classes (3 treatment groups; 2 NE+G, 2 NE and 2 Control) 76 treatment 39 control Pre- and post-assessments	NE+G; received both nutrition education and garden NE; received only nutrition education Control (non random assignment) Fruit and veg. survey Taste and rate questionnaire Lunchroom observation NE; 10 week program NE&G; 10 week program plus 45 min in the garden four times a week Control; did not complete any nutrition-related lessons or garden-based experiences 24-hr recall Taste and rate methods Fruit and Veg. Knowledge questionnaire	Gardening students correctly identified sig. more veg. than those in the control group (p<.002) Gardening students sig. increased their preference for veg. (p<.029) Gardening students tried sig. more varieties of veg. than those in the control group Both treatment groups sig. improved nutrient-food association, nutrient-job association knowledge, fruit and veg. identification, and ratings of tasting, over the control group (p<.001) NE+G group was better able to identify certain veg. over both other groups
S.M. Parmer, J. Salisbury-Glennon, D. Shannon, and B. Struempfer (2009)	Clarify the effects of a school garden on children's fruit and veg. knowledge, preference, and consumption	four classes of Grades 5/6 NE&G(35students), NE(35 Students), Wait-list Control (57 Students) Non random assignment Quasi-experimental pre-and post-intervention		NE&G and NE groups were sig. more willing to taste veg. and rated the tastes more highly than did the control group (p<.001) NE&G group showed a sig. positive dif. In willingness to taste and eat veg. as a snack than NE and control group(p<.001)

In 2009, Sondra et al. found that among second graders there was an overall change in food group knowledge, but that change could not be attributed to the group

assignment of the students. The NE and NE+G groups did show significantly greater improvement in nutrient-food association knowledge, nutrient-job association knowledge, and fruit and vegetable identification when compared with the control group. Morgan et al. (2010) found that among fifth and sixth grade students those involved in the NE and NE+G groups were significantly more willing to taste vegetables and rated the tastes more highly than did students from the control group. Significant differences for fruit and vegetable knowledge and vegetable identification only occurred between the NE+G group and the control group for students who started with lower scores at baseline. No differences were found between the groups for vegetable intake.

Alaimo, K., Packnett, E., Miles, R. A., & Kruger, D. J. (2008) did a study of adults in Flint, Michigan to compare their, or family members, involvements in community gardens and their fruit and vegetable consumption. They found that on average, those adults with a household member who participated in a community garden consumed more fruits and vegetables and were more likely to eat fruits and vegetables at least five times a day (Alaimo et al., 2008).

Four studies (Table 3) were reviewed that evaluated the effect of school gardens on students' environmental attitudes (Skelly & Zajicek, 1998; Waliczek & Zajicek, 1999; Waliczek, Bradley, & Zajicek, 2001; Robinson & Zajicek, 2005; Skelly & Campbell Bradley, 2007; Aguilar, Waliczek, & Zajicek, 2008). One brief study was conducted with high school students. The researchers utilized a Pearson product-moment correlation to analyze the relationship between success scores on a propagation experiment and the students' environmental attitude score. The Pearson product-moment was found to be .70 showing a high correlation (Campbell, Waliczek, Bradley, Zajicek, &

Townsend, 1997). This study supports other research in that there appears to be a relationship between environmental attitudes and success gained from natural experiences.

Table 3

School Gardens and Environmental Attitude Change – Quantitative Assessment

Authors, by date published	Objective	Sample and/or Design	Tools/Instruments	Results
A.N. Campbell, T.M. Waliczik, J.C. Bradley, J.M. Zajicek, and C.D. Townsend (1997)	Determine if educators, by using school curricula and action-based learning, can ultimately influence the environmental attitudes of students	9th-12th grade students(44 students) Pre- and post-test questionnaire	1/3 classroom lecture and 2/3 activity time Semester long propagation experiment Modified New Environmental Paradigm and percent success on propagation experiments	Environmental attitudes were correlated to student success with the propagation experiment (Pearson product-moment correlation of .70)
S.M. Skelly and J.M. Zajicek (1998)	Develop an interdisciplinary garden activity guide and to evaluate whether children developed positive environmental attitudes by participating in such activities	2nd and 4th grade students from four elementary schools in Texas (Experimental group-153 Students, Control group-84 Students) Post-survey only	Experimental group-Garden materials from ProjectGREEN and Raised garden beds installed Children's Environmental Response Inventory	Sig. dif. Were found in environmental attitude scores of children in the two groups (p<.001) The more outdoor-related activities a child experienced, the more positive environmental attitude score they possessed
T.M. Waliczek and J.M. Zajicek (1999)	Develop a garden activity guide and evaluate whether students were developing positive environmental attitudes by participating in the school garden program.	598 students in Texas and Kansas schools. (2nd-8th Grade Students) Pre- and Post-test	Project GREEN curriculum Developed Environmental attitude inventory	Pre-test mean score was 31.45; posttest mean score was 31.71, t=-1.712 (p<.10) Gender and ethnicity had a significant effect on environmental attitudes
O.M. Aguilar, T.M. Waliczik, and J.M. Zajicek (2008)	Examine an interdisciplinary and experiential approach to environmental education and evaluate its effectiveness on promoting positive environmental attitudes	654 students third through fifth graders in Texas (Experimental group;461 students, Control Group; 193 students) Post-test only	Junior Master Gardener Handbook Level 1 Gardening Program Combination of; Children's Environmental Response Inventory, and Environmental Attitude Inventory, and the Revised Perceived Environmental Control Measure	No sig. dif. in environmental attitude scores between the experimental group and the control group. Sig. dif. Were found in environmental attitude scores based on comparisons of gender, ethnicity, and previous gardening experience (p<.05)

In 1996-97 Skelly & Zajicek conducted a study of second- and fourth-grade students in Texas. They found significant differences in the environmental attitude scores of garden and non-garden students. Garden students on average scored higher than non-gardening students. They also found that age and previous gardening experience played no role in the students' environmental attitude scores for either group. A study conducted in 2008 by Aguilar, Waliczek, & Zajicek found different results. The researchers in this study found no significant differences in students' environmental attitude scores between gardening and non-gardening students. The researchers found that gender and ethnicity greatly affected the students' scores. A previous study conducted in 1999 found similar results (Waliczek & Zajicek, 1999).

One study (Table 4) examined the affect that school gardens had on the life skills of elementary school children (Robinson, C., & Zajicek, J., 2005). Robinson and Zajicek found that student participating in a school garden program had significantly higher overall life skills scores on posttest when compared to their own pretest scores. They concluded that it appeared these positive influences occurred regardless of the students' age, gender, or ethnicity (Robinson, C., & Zajicek, J., 2005).

Table 4

School Gardening's Effect on Self-Esteem and Life Skills – Quantitative Assessment

Authors, by date published	Objective	Sample and/or Design	Tools/Instruments	Results
+69C.W. Robinson and J.M. Zajicek (2005)	Assess changes in the life skill development of elementary school students participating in a 1-year school garden program	Third, fourth, and fifth grade students from Texas. 281 students total (190 students in the experimental group and 91 students in the control group) Pre- and Post-test	Garden program curriculum and teacher training Author created Youth Life Skills Inventory	No difference in pre-test and post-test scores for the control group. (p<.05) Statistically sig. dif. Between pre-test and post-test scores of the garden program group (p<.05)

Common limitations can be found among almost all of these studies. The school day and curriculum cannot permit students to be placed in randomized groups for testing and most subjects volunteered for the studies. In most cases, the primary researcher and author was the person collecting the data. It is possible that through data collection a bias was created showing more positive results than what really occurred. These issues will be discussed more in-depth in the Conclusions and Recommendation section of this paper.

Qualitative Assessment of School Gardens

This study reviewed seven qualitative assessments of school gardens. In three of the assessments the author was directly involved in the implementation of the garden. These three studies are summarized in Table 5, the other four studies are found in Table 6. Although each study was designed differently and sought to answer different questions, common themes were found throughout. These themes are summarized in the tables and will be discussed here in greater detail.

One common theme reported by six of the seven studies was the inherent pleasure that students and teachers received by working in the gardens. Researchers who were actively involved in the implementation of these gardens wrote about the joy and excitement kids showed for working in these spaces (Alexander, North, & Hendren, 1995; Brunotts, 1998; Brynjugard, 2001; Canaris, 1995; Lautenschlager, L., & Smith, C., 2007; Morgan, Hamilton, Bentley, & Myrie, 2009; Thorp & Townsend, 2001; Faddegan, 2005). The sole factor that gardens are not classrooms might be what inspired students to work. Brynjugard (2001) stated that only students with good behavior were allowed to

work in the gardens. Gardening in that case served more as a reward rather than a task or job to be done.

Table 5

Case Studies of School Gardens (Direct Involvement of Author)

Authors, by date published	Objectives and location of Garden	Sample and/or research design	Observations from and Impacts of Garden
Canaris (1995)	Vermont public school children (1st-4th Graders) worked with local farmer to establish a snack garden and to learn where food comes from.	2 year teacher retrospective	Increased math, reading, writing, and social skills Develop student, parent, and community involvement Create pride in regional culture and a sense of appreciation for farmland and food production
Brynjegard (2001)	Research question: by working in the garden do children gain unique insights into some environmental issues? AmeriCorps volunteer working with students at an elementary school in Napa, CA.	Interviews and observations of students, parents, and teachers at three elementary schools in the San Francisco Bay Area and work with The Watershed Project through AmeriCorps	Gardens need at least one dedicated adult to spend their entire time making the garden work. Support from teachers and an administrator is also required in order for gardens to exist successfully. Gardens work better when they are designed for the whole school and not just for certain classes. This helps reduce vandalism and accidental damage. Students benefit more from gardening experiences when they are given the opportunity to make decisions that affect the garden.
Cutter-Mackenzie (2009)	Gould Group in Australia sought to develop multicultural school gardens (Dalem Primary School was followed in this study) to bring communities together, to garden, cook, and learn from each other	Children as researchers (Journal, photographs, and peer interviews) Researcher field visits, observations and interviews with children and teachers	Gardening creates a community of learners and allows students to partake in cultural learning Gardening can be linked to teaching English as a Second Language Gardens help students make nature and environmental connections

Table 6

Triangulated Qualitative Methods and Analysis of School Gardens

Authors, by date published	Objectives or questions	Sample and/or research design	Observations and/or Themes
J. Alexander, M.W. North, and D.K. Hendren (1995)	Pilot study to Identify and evaluate the short-term effects of classroom garden projects put on by the master gardeners	52 inner city second and third grade students in San Antonio, Texas 3 gardening classes, 2 non-gardening controls Observations and interviews with principal, 5 teachers, 3 parents, master gardener, and the 52 students.	Moral development related to valuable life lessons that students are exposed to during the gardening experience Academic Learning related to hands-on experience in the garden Parent, child, and community interactions facilitated by gardening experience Student pleasure stemmed from rewarding interactions with others in the garden Master gardener integral part of classroom gardens Fear of vandalism, desire to protect the gardens
L. Thorp and C. Townsend (2001)	Phenomenological understanding of the impact of a garden-based agricultural education curriculum on k-5 students in a low-income, multiethnic, Midwestern elementary school. Evaluate the effects of school gardens on students and teachers. Determine if the gardens are perceived as useful and identify any barriers or impediments to using the garden.	Purposive sampling of 5 teachers and 40 students Multiple qualitative methods: interview, conversation, observation, photo elicitation and document analysis	Garden connected students to the school and reshaped school culture Garden restored sense of control and place in teachers' and students' lives Garden provided opportunities for students to gain life experience that were very positive Garden provided space for both students and teachers to show expression, creativity, and innovation Gardening changed everyone's view of food
L. Lautenschlager and C. Smith (2007)	Explore the effects of community gardens on youth dietary behaviors, values and beliefs, and cooking and gardening behaviors	Six focus groups; YFMP youth(3 groups; 26 students) Non-YFMP youth (3 groups; 14 students) Qualitative data collection from focus groups(all groups audio-taped and transcribed verbatim)	YFMP participants were able to articulate garden knowledge more clearly than those not involved in the program Gardening influenced ethnic and unfamiliar food consumption Gardening shaped youth's value systems, teaching respect, social values and appreciating differences between people YFMP participants were able to articulate nutrition knowledge more clearly than non-YFMP participants Gardening affected students' views of cooking with fresh foods
S.C Morgan, S.L. Hamilton, M.L. Bently, and S. Myrie (2009)	Exploratory study of Brooklyn Botanic Garden's Project Green Reach (PGR) children's program and the long term influence on the students involved	Many qualitative methods: non-participatory observing, collecting and analyzing program documents and records, and interviewing alumni(N=4) and current and former staff members(N=1)	PGR Program participants come from challenging home and school environments Participants developed academic and interdisciplinary skills Participants gained increased understanding of science concepts and gardening skills Development of environmental awareness and appreciation Social development and growth Overall positive life experience Culturally significant to the participants; community

Note. YFMP= The Youth Farm Market Project

A second common theme reported by six of the seven studies was the active involvement of the community. Community backing can make or break many school gardens. Gardens had a strong community building element that promoted student bonding, outreach to community members, interactions with parents and other adults, and a chance to explore culture differences (Alexander et al., 1995; Brynjugard, 2001; Canaris, 1995; Cutter-Mackenzie, 2009; Morgan et al., 2009; Thorp & Townsend, 2001; Langhout, R. G., Rappaport, J., & Simmons, D., 2002). Canaris (1995) remarked that if it were not for the community support and expertise they received from one local farmer, their snack garden program would not have been able to thrive as it did.

Improved school attitude and pride were cited by six of the seven studies as arising from the gardens. Students were eager to show off their garden space and many wanted to take their produce home (Alexander et al., 1995; Brynjugard, 2001; Canaris, 1995; Moore, R., 1995; Cutter-Mackenzie, 2009; Morgan et al., 2009; Thorp & Townsend, 2001; Faddegon, P. A., 2005). Alexander et al., (1995) used interviews with parents to reveal just how proud the students were. Many parents reported that the first thing their son or daughter mentioned from the school day was their time spent in the garden. Gardens can create such a sense of school pride that Brynjugard (2001) suggested that gardens be created for all students to use, and not just for certain classes. She concluded that vandalism or even accidental destruction could be prevented by making students feel that the garden was their area and a space they could take pride in.

Again, six of the seven studies found that gardens provided students with the opportunity to execute a wide range of academic learning. Researchers indicate that gardens can be used to teach a wide range of subjects including, but not limited to, math,

writing, environmental stewardship, and science (Alexander et al., 1995; Brynjugard, 2001; Canaris, 1995; Cutter-Mackenzie, 2009; Morgan et al., 2009; Thorp & Townsend, 2001). The multicultural school garden studied by Cutter-Mackenzie (2009) was used to teach English as a second language, cultural diversity, and environmental education. Teachers who were interviewed cited that the gardens allowed them to teach across the school curriculum (Alexander et al., 1995; Thorp & Townsend, 2001).

Three of the seven studies illustrated how gardens provided students a chance to learn about nutrition and to grow their own healthy food (Canaris, 1995; Lautenschlager, L., & Smith, C., 2007; Thorp & Townsend, 2001). One study, in particular, put a great amount of focus on the effect gardening had on children's' dietary habits.

Lautenschlager and Smith (2007) reported that participants in the Youth Farm Market Project (YFMP) in Minneapolis/St. Paul, Minnesota understood the importance of consuming healthy foods more so than non-YFMP participants. YFMP participants were also more willing to consume ethnic or unfamiliar food. YFMP participants were better able to articulate nutrition knowledge, and could verbalize what it meant to be healthy (Lautenschlager & Smith, 2007). In the study conducted by Canaris (1995) students and teachers used their school garden to develop a healthy snack program. Students grew lettuce, corn, potatoes and several other vegetables in this garden. Teachers indicated that because students had an active part in growing the produce, they were more likely to eat the healthy foods (Canaris, 1995).

In two of the seven studies, gardening was paired with cooking lessons, and recipe development to further students' learning (Canaris, 1995; Lautenschlager, L., & Smith, C., 2007). Cooking lessons are a key component of the YFMP program.

Lautenschalger and Smith (2007) reported that the program's participants used their cooking skills at home as well. Parents, teachers, and students worked together to can dilly beans grown in the school garden. Students wrote their own recipes and practiced their math skills when trying to triple recipes (Canaris, 1995).

In order for school gardens to prosper, dedicated garden directors were needed. This was emphasized by four of the seven studies. These dedicated garden directors ranged from local farmers (Canaris, 1995), to America Corps volunteers (Brynjegard, 2001), to Master Gardeners (Alexander et al., 1995), to simply a dedicated teacher. Thorp and Townsend (2001) suggested that it is best to have a dedicated volunteer from outside of the school hierarchy manage the day to day routine of the garden. Teachers are not always the most well trained or best equipped people to manage gardening activities; in addition to the full-time job of managing a school classroom.

Cafeteria-based Intervention

This paper reviewed one study that sought to find if cafeteria-based intervention would increase the fruit and vegetable consumption of children (Perry, C., Bishop, D., Taylor, G., Davis, M., Story, M., Gray, C., Bishop, S., Mays, R., Lytle, L., & Harnack, L., 2004; Stables, Young, Howerton, Yaroch, Kuester, Solera, Cobb, & Nedbeling, 2005; Davis, Cullen, Watson, Konarik, & Radcliffe, 2009). The study used the Cafeteria Power Plus project in 13 schools in Minnesota 13 other schools served as control schools. In the control schools the Cafeteria Power Plus project was implemented after data was collected. (Perry et al., 2004). The researchers reported that in the intervention schools there were increased opportunities during school lunches to eat a variety of fruits and vegetables, healthful role models, and social support for children (Perry et al., 2004).

Although the researchers did report a significant increase in fruit and vegetable intake among intervention students, they discussed the fact that the change was not as large as those seen when multi-component interventions were used. These multi-component interventions were likely to include school gardens and parental involvement.

Farm to School Programs

Little research has been conducted on the use of these school gardens in connection to Farm to School programs (FTS). Canaris (1995) reported on the use of a school garden to produce healthy snacks for a group of students and many other schools are currently using gardens to provide fresh salad bars for school lunches. Izumi, Alaimo, and Hamm, (2010) conducted a qualitative study using a case study approach to investigate the potential of Farm to School programs. They also looked into how these programs could improve students' diets and they explored the market opportunities given to farmers. This paper reviews results and lessons learned from Farm to School programs in Michigan and Wisconsin. Wisconsin has been operating the Wisconsin Homegrown Lunch (WHL), a Farm to School project, since September 2002 (Kloppenburg, Wubben, & Grunes, 2008). Kloppenburg et al. (2008) found that when the barriers of Farm to School programs were examined there were three common themes that arose; cost, procurement, and supply. Fresh foods are often thought to be more expensive than traditionally processed foods. To buy local, fresh foods must come from small local farmers. Cafeteria staff had concerns that their supply would not meet the demands of the school and that procurement of those foods would be much more complicated. They also found that most school cafeterias were not set up to handle and process fresh foods. As with school gardens it was also noted that in order for FTS to survive, the guidance and

cooperation of principals and food service directors was a must. Kloppenburg et al. (2008) also explained that the WHL has explored different avenues to incorporate fresh foods into schools, such as vegetable snacks during the school day.

In 2003, a survey was conducted on the food service directors in Michigan. The results from this survey showed that seventy-three percent of food service directors showed interest in purchasing food directly from local producers (Izumi, Rostant, Moss, & Hamm, 2006). Just over ten percent of the directors were willing to pay higher prices for local produce (Izumi et al., 2006). It comes as no surprise, then, that the respondents (76.2%) were concerned with cost, reliable supply, and food safety. The researchers did indicate that overall it appeared that among the directors there was widespread interest in FTS and that the directors wanted to support their local economy.

Synthesis

Based on the literature reviewed, it was clear that school gardens can be used to encourage students' to eat fresh foods, and can give them a way in which to grow these foods themselves. Recent scientific research has demonstrated the effectiveness in school gardens to improve fruit and vegetable consumption among children, increase nutritional, science, and gardening knowledge, as well as improve their environmental attitudes. Several key empirical findings have surfaced that show that school gardens build community and parental involvement, and provide students and teachers with a pleasurable experience. Contrary to prior belief, the research showed that teachers have found gardens can be used to teach a variety of subjects and are cross curricular. Although there are barriers to using school gardens and Farm to School programs;

principals, cafeteria directors, teachers and students are eager to see what the future holds. Altogether, the literature reviewed underscored the need to review further the possible connections between school gardens, Farm to School programs, and the effects they will have on the local community and students involved. Future research would set the standard for Farm to School programs and would develop a standardized curriculum for teachers to use in school gardens.

CHAPTER 3

CONCLUSIONS AND RECOMMENDATIONS

Summarized here are the current practices, attitudes, and barriers to using and working with school gardens. Recommendations for the future are presented and include suggestions for future research, as well as a description of what could develop out of Farm to School programs in the future.

Current Practices

Gardens are used in almost every state and by many different types of schools and organizations. Graham et al. (2005) reported in their findings that high schools were using gardens to teach both agriculture studies and science. Most research is being completed at the elementary level and it is clear through current research that gardens are being used effectively to enhance the school curriculum. Gardens at the elementary level are being used to teach math, science, reading, writing, English as a second language, cultural diversity and many other subjects (Thorp & Townsend, 2001; Cutter-Mackenzie, 2009; Blair, 2009)

Attitudes

Attitudes surrounding school gardens appeared to be mostly positive. Several studies recalled the pleasure students feel when working in the gardens. Teachers, parents, and garden managers alike can see the joy and benefit they bring to the children working in them. A school garden cannot be all sunshine though. At times gardens can be costly and hard to maintain. Lack of external funding can cause many school gardens to close (Azuma, Horan, & Gottlieb, 2001). Thorp & Townsend (2001) made an effort to explain the culture of schooling and describe the pressure put on teachers to meet certain

standards. Sometimes gardens fall to wayside because school administrators fail to see the benefits to those involved.

Barriers to Academic Instruction

Time appeared to be the biggest barrier to using school gardens in academic instruction (Graham et al., 2005; Graham & Zidenberg-Cherr, 2005). Graham et al. (2005) and Graham & Zidenberg-Cheer (2005) reported lack of teacher interest and experience and the lack of curricular materials are also barriers. Most elementary school teachers are not well versed in horticulture or gardening practices, so it is logical that they would feel uncomfortable working with the students in such settings. Although more curricular materials have been made in recent years to aid teachers in using school gardens to teach lessons, teachers must be creative in linking outdoor lessons with the school curriculum.

Barriers to Farm to School Programs

As Farm to School programs become more popular, and as the trend to buy local increases, more barriers to using fresh foods are sure to be uncovered. Currently cost, procurement, and supply were concerns shared by cafeteria directors. Fresh local food was often unprocessed and many school cafeterias were not set up to handle that. It was likely that small farmers, in truth, could not produce enough food to meet the schools' demand, but food from several small farms, and/or from school gardens themselves could. Kloppenburg et al. (2008) stressed the importance of having the support of cafeteria staff to make Farm to School programs work. Often it is the cafeteria staff workers who get the short end of the stick. The use of fresh ingredients means more work for these people. If they are not on board, Farm to School programs suffer.

Benefits

The research highlighted the many benefits that school gardens provide to not only students, but all those involved. School gardens affected students' fruit and vegetable consumption, their environmental attitudes, their science achievement scores, and their life skills. Although the long term benefits of school gardens have not been examined in depth, Morgan et al. (2009) interviewed alumni of Brooklyn's Garden Project Green Reach. They reported that even fifteen years after their participation in the program they described it as a "positive life experience" (Morgan et al., 2009, pp.47). The benefits students receive from school gardens at a young age are likely to stick with them for years to come.

Recommendations

Although more and more research on school gardens has surfaced over the past five years, even more research needs to be done in this area. Several topics have been suggested for future research including; academic and curricular benefits, reading achievement and accountability, comparing learning values to money and time invested, health, nutrition, fitness, and life skills and resiliency (Phibbs & Relf, 2005). Research should also be focused on the long term effects school gardens have on students. More quantitative and qualitative research needs to be done with high school students as well. It is likely that this age group will benefit from gardens in different ways than younger children.

School curriculum needs to be amended to include the use of school gardens. If teachers had access to curriculum designed for use in the garden, they would be more likely to use school gardens in their lessons. With the added guidance, children are sure

to learn more and gain more from the experience. These curriculums could be tested in small case studies first, and then, if positive results ensue, established statewide.

The use of the school gardens in Farm to School programs needs to be further investigated. Current research shows that produce grown in the gardens is sometimes used for healthy snacks in class. In Illinois, with the current House Bill, it would be nice to see produce from school gardens used in school meals. Schools could implement snack bars, salad bars, or many other fresh food stations to help meet state requirements on using local foods. Gardens at the high school level open the doors to many new subject areas that could be taught in conjunction with the garden. Students could be involved in the planting and harvesting of the produce, while other classes focused on food processing could prepare the food for use in the school cafeteria. The expansion and use of school gardens opens up a door of endless possibilities that must be further explored and researched.

The future is bright for the use of school gardens. The possibilities of using school gardens in Farm to School programs are just emerging. With continued backing and the positive attitudes surrounding school gardens, the barriers to using them can be reduced and their positive effects intensified. With continued research, the development of a garden curriculum is achievable and the use of these gardens at the high school level is attainable.

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VITA

Graduate School
Southern Illinois University

Corinne Elizabeth Schaidle

Date of Birth: August 21, 1987

1200 E. Grand Ave Apt. 5-1B, Carbondale, Illinois 62901

522 Santa Fe Trail, Metamora, Illinois 61548

cbs109@hotmail.com

Southern Illinois University Carbondale
Bachelor of Science, Plant and Soil Science, May 2009

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Major Professor: Seburn L. Pense