

Gardening and Nutrition Curriculum for Standard II at Faith Nazarene

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Introduction

Gardening is an essential element to human life. Growing food is something that occurs throughout the world; however, the context of growing food has changed in recent years. With rising concern for environmental degradation, a more sustainable approach to gardening has occurred; this approach encourages less chemical usage to produce healthier crops along with a healthier environment. Partnered with this new agricultural focus is a nutritional aspect that emphasizes a balanced diet of fresher, less processed foods. The Garden and Nutrition Project for Faith Nazarene is a service-learning project established to develop a curriculum for Standard II classrooms to link together sustainable gardening and nutrition education.

In Belize, where the average diet emphasizes processed grains and starches, there is a need for nutrition programs to be established. Health problems in the country are largely due to poor diet. Rates of vitamin A deficiency and anemia (an iron deficiency) are high and continue to grow in children from ages two to eight years old. Cardiovascular and heart diseases are also prevalent and were the leading cause of death for males and females in Belize from 1993 until 1996. All of these health problems can be corrected by practicing a healthier and more balanced diet.

Promoting an education in gardening helps children become aware of where their food is coming from and why it is important for humans to take care of the environment that produces that food. Engaging children at a young age helps to shape their views of food and nature. It also is a chance to expose them to fresh, healthy foods and recipes they can try at home to improve not only their own diet but the diet of those around

them simultaneously. For Belize, a gardening and nutrition curriculum could help set the wheels in motion for a healthier generation. The goal for the Gardening and Nutrition Curriculum at Faith Nazarene is to provide the school with materials, like raised garden beds, and lesson plans that link the gardens on campus to nutrition. This will help allow for the school to continue educating children about health and the environment.

Gardening Methods

Preparation:

Our first meeting with the students in Standard Two at Faith Nazarene involved observing professor Humes as he taught a grammar lesson. We felt this was important so we could see how Professor Humes conducted his class and get a glimpse of the dynamics within the classroom. At the end of his lesson we introduced ourselves and described the Gardening and Nutrition program.

For our second meeting with the students, a quiz was given (Appendix 2) that was designed to get a better understanding of how much the students already knew about gardening; what kind of fruits and vegetables they liked or disliked; and how much they knew about nutrition. The questions were read out loud, as well as written on a handout that was given to the students, to make the quiz as easy and comprehensible as possible.

Lesson Plan 1:

To begin the next lesson a short presentation was given on what composting is, why it is important, and how it is done. Then the students were split into three groups of 10. Each group was given a different vegetable: lettuce, tomatoes, or radishes (we picked these three vegetables because they don't generally take too long to germinate and they can grow in Belizean climates). They were also given a styrofoam cup and a small shovel. After the students were split up and given their supplies, the leader for each group (either Renee, Katherine, or Katie) demonstrated how to read the seed package label, put soil into their cup without compacting it too much, dig a small hole, and plant their seeds. A watering monitor was then assigned and the class was told

when to bring their plants into the direct sunlight and when it was O.K. to bring them back inside.

Lesson Plan 2:

While the plants were germinating, lessons were conducted to teach the students about different aspects of gardening. These lessons consisted of games and activities. Some activities were more successful than others. The first lesson post-planting consisted of three different stations of activities. The students were split into their planting groups and took turns at each station. One station was “bug twister,” which was basically the same as normal twister, except instead of colors there were six different types of bugs. These bugs were either helpful or harmful to gardens. When a student landed on a certain bug he/she had to say whether it was helpful or harmful to the garden. Another station was a matching game where the students had to match the description of a certain plant to its name. Samples of the plants were shown to the students to make this station more interesting. The final station was a tour around the Faith Nazarene campus to decide where the best place to put the raised beds would be. The students had to decide where the garden would get the best light, where it would be out of danger from other students playing, and where there would be a flat enough surface for the boxes to rest. Each group spent 10 minutes at each station.

Lesson Plan 3:

The next lesson was shorter because of scheduling issues. A presentation was given on the different parts of the plant and the students were quizzed on what they had learned. Different seeds were then passed out to groups of four and each group had to guess which type of seed they were given.

The final session before transplanting the seeds and building the boxes began with a lesson on how to safely transplant the seeds. A picture was drawn on the chalkboard for each step. Below the picture a description was written on a flash card, which the kids read aloud. Afterward the written steps were taken down. We planned to have a student come to the front and put them back up in order, but we ended up being short on time to do this activity. After the lesson on transplanting, the students were given index cards and colored pencils so that they could design labels for their seedlings. This activity was designed to make the students feel more ownership over their seedlings, so they might be more interested in taking care of them.

After the garden lessons had been completed, all the lessons were put into an easily readable curriculum format (Appendix 3).

Nutrition Methods

Preparation

For the nutrition curriculum at Faith Nazarene, we sought to introduce basic nutrition concepts and link them with the gardening activities put in place on campus. First, we developed a pre-quiz to give out to the students (Appendix 2) in order to see what the kid's prior knowledge was about vegetables, gardening, and healthy eating. The quiz asked simple questions that included: examples of the food groups; what kinds of fruits and vegetables the kids liked and disliked; and what kinds of foods and meals were being served at home. The quiz enabled us to get a feel for what foods we would try growing in the garden, and what foods we would try to promote in order to balance out their normal eating habits throughout our curriculum. The quiz was also for comparison of before and after the curriculum since we would be giving the same quiz at the end of the semester to see if answers changed at all.

Balanced Diet

Next, we developed a lesson plan that would introduce the children to the idea of a balanced diet (Appendix 3). This consisted of teaching them about the food pyramid and food groups. Based on what foods we knew could be grown here at the school and in Belize's climate, we focused the lesson around local vegetables and fruits that they should be eating more regularly. We also taught them about different ways to break up the food groups so that it was easier for them to know how to put together a day of balanced meals. It was important to emphasize fruits and vegetables first, followed by starches and grains second. This touched on some of the health issues that we had

researched, such as heart disease and cardiovascular disease that result from diets rich in starches and processed grains.

Snack Preparation

Since children are always snacking in between meals and in need of more calories for growth, it is important to promote a variety of healthy snacks for them to try. We developed a piece in the curriculum dedicated to mixing and matching foods from each food group to make healthy snacks that the children would enjoy (Appendix 3). First, we had to evaluate what foods in Belize were most affordable to the average household and most accessible as well. This is important so that each child has access to these snacks and is able to eat them on a close-to-daily basis. After having activities that surveyed what kinds of foods the children had access to and enjoyed, we made up a booklet of healthy snack recipes and combinations for the children keep and take home to share with families and friends. Then we proceeded to do a taste test of new combinations of foods that were included in the booklets. The taste test consisted of four different combinations: yogurt, local fruit cup, oatmeal with raisins and honey, and local peanut butter with carrot sticks. As children rotated from station to station, they circled on a scale from 1 to 10 how much they enjoyed the healthy snack. This gave the children new ideas for healthy foods and promoted fresh, local foods for them to try in place of processed snack mixes.

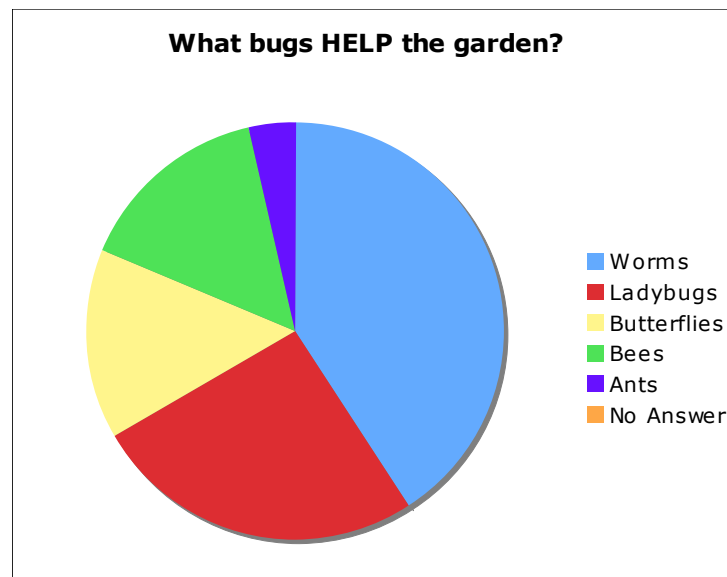
These nutrition activities and curriculums are focused on changing the current diet in Belize, which emphasizes starches and processed foods, to one that is rich in fresh, local foods that are affordable and accessible. Using the pre-test helped us to evaluate what the children were used to seeing on their plates and what foods they enjoy. Educating them about the food groups and food pyramid helped to emphasize

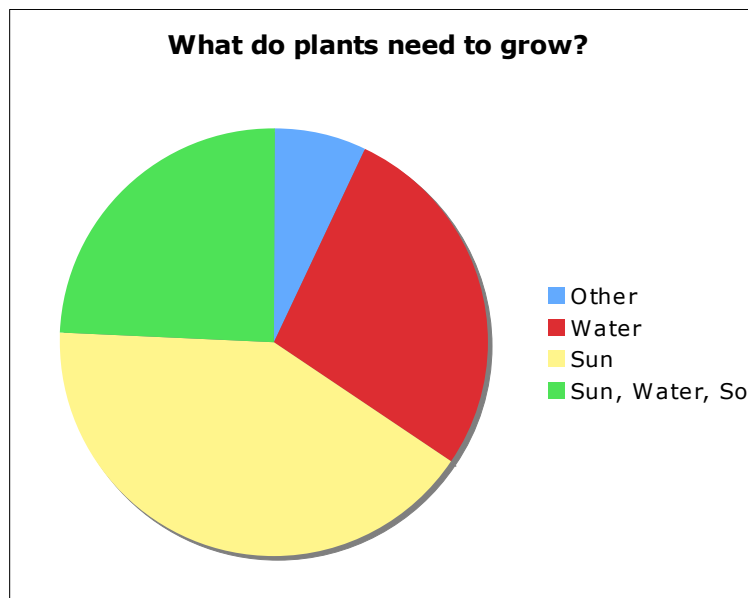
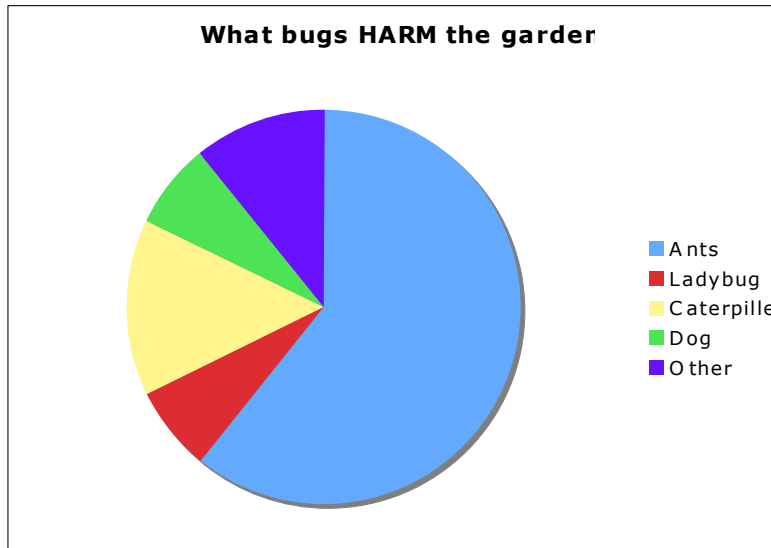
both variety in their diets and eating more fruits and vegetables than they might currently be eating at home. The recipe booklets and taste test will give the children and their families new ideas for foods and combinations that they might not be used to but may enjoy equally as much. Altogether this curriculum provides new education about developing a healthy diet and trying new foods that are locally grown.

Gardening Results & Findings

The gardening program at Faith Nazarene successfully built and planted a school garden while making gardening appealing to students. The students of Faith Nazarene did not exhibit extensive knowledge of gardening, compost, soil quality on the pre-test that was administered in February. The pre-quiz and following gardening lessons sparked student's interest and the class was progressively interested in gardening and gardening techniques. The students were very proud of their seedlings and could hardly wait for the garden area to be prepared so they could transplant their seedlings and plant new produce.

Before, the students did not illustrate garden knowledge on their pre-test, but they did demonstrate basic gardening knowledge during our gardening lessons. Many students had been a part of a garden in the past, but few continued to garden. The follow up quiz (Appendix 8) helped us to evaluate how much information they retained from the lessons. Below are pie charts that clearly display that the majority of the class answered three of the questions that tested their gardening knowledge correctly.





Many students verbally agreed to suggest planting a garden to their parents, so perhaps our project has inspired gardens outside of the garden at Faith Nazarene Primary School.

The gardening project did not yield produce during our few months of involvement. By the time the gardening area was finalized and the raised beds were constructed, our program had little time left in the semester. Our post curriculum will assist Mr. Humes in maintaining and harvesting the plants we planted in the final lesson

of the program. Along with harvesting produce this year, Mr. Morris, the assistant Principal of Faith Nazarene, has agreed to utilize the raised bed garden next year. In an effort to incorporate school grown produce in the school cafeteria, Faith Nazarene , which, has rented out the school cafeteria to a third party in the recent past , is prepared to take over the cafeteria next school year. Our group will provide Faith Nazarene with research necessary to carry out such a program, including uses for the space provided by the raised beds and healthy recipes that inexpensively incorporate produce from the school garden.

The school garden at Faith Nazarene will, hopefully, encourage Belizeans of the Faith Nazarene community to garden at home. The garden is in a centralized location that we hope will be area that is respected and taken care of by the entire Faith Nazarene community, not simply Mr. Humes' class. The project aims to encourage Belizeans to grow their own food, as the price of imported produce has become very expensive. Home gardens are not only feasible with the Belizean climate but they were common until recently. Fortunately, many Belizeans have the space and the knowledge to grow their own food and perhaps programs such as ours will encourage them to return to gardening to sustain them. Our project will, hopefully, open the door to future service learning and school gardens here in Belize.

Nutrition Results & Findings

Our nutrition lessons had the intended outcome of helping children make more informed decisions about the foods they and their families eat. The results were identified by giving the students a second, follow-up quiz (Appendix 9) where we asked about what kinds of foods the children decided to eat for snacks and meals. The quiz proved that they were able to understand what made a food qualify as a healthy snack. Their answers showed that they remembered the types of foods tried in class and that some of their families at home are eating similar healthy foods.

We were able to expose children to new kinds of snacks, like oatmeal, raisins, local peanut butter, and yogurt. This was important because we tried to pick new foods that were not necessarily popular in current Belizean diets but that would still be available and affordable for them to purchase and consume. The results of this exposure allowed for children to figure out what kinds of healthy foods they liked and disliked so that they could make new choices in their future diets.

Nutrition lessons are important for this Gardening and Nutrition project because they help link children with healthy foods and a healthy environment. The gardening portion of the curriculum shows the students how to plant and learn about nature and what nature can supply humans with. The nutrition portion of the curriculum helps to show children why fresh and local produce is healthy for humans and why it is necessary to include more fresh and local produce in their everyday diet. Teaching this to students is important to improve their diets, environment, physical and mental health.

Future Recommendations: Gardening Maintenance & Curriculum

In order to keep the garden working, the first lesson of a future curriculum should focus on teaching about care and maintenance of the raised beds. A system should also be put in place to make sure at least one student is monitoring the seedlings at all times, especially on the weekends. It may also be a good idea to get all the students little shovels so that they can be enthusiastic about making their own garden. The fence will help to protect the garden from outside disturbances.

The next lesson should focus on making signs for the raised beds so that the different crops can be identified. This will also help the other students attending the school to be able to understand what the garden is for and what foods are grown locally. It will also be helpful for the students to do activities focused on how to space seeds within the raised beds so that they know how to grow and care for their garden.

The rest of the curriculum should include more information specific to the plants that the children are growing. If the students know more about what their plants need, they will be better equipped and motivated to take care of them. The lessons should also include more information about composting, since this was something that the children did not understand in the beginning. Having the students build their own compost from food scraps and leftover food would be helpful to making the school a more sustainable campus, while teaching the children how compost benefits the garden.

There should also be some lessons about different garden tools and how to properly use them. This will be important for students to understand how to garden on

their own as well as to make sure that the students are safely using the tools. Games like matching vegetables and bug twister can be used again in order to provide activities while the plants are germinating. This will help the students understand all aspects of the garden and what it takes to create, maintain, and harvest a vegetable garden in Belize.

Future Recommendation: Gardening for School Cafeteria

The gardening beds installed at Faith Nazarene can be used to supply food for the school cafeteria. The school will need to identify a staff or community member to manage the garden and oversee cafeteria planning that incorporates garden harvest. With local gardening knowledge and Belize's tropical climate, the garden can easily prosper in the upcoming school year.

There are many programs in the United States that are utilizing school gardens as a means of producing healthy food for student consumption. Faith Nazarene primary school has a student body of manageable size that can easily benefit from healthier cafeteria food, supplemented by the school garden. Many pilot programs in the United States provide information necessary to make such a program successful at Faith Nazarene. Please review the links in Appendix 8 to explore the many programs that utilize school gardens to provide healthy food. These links offer many ideas that can be tailored to fit Faith Nazarene's student body, taking into consideration cultural and economical differences between Belize and the United States.

The programs in the United States have many advantages relative to Belize, funding is one of them. However, Belize has some advantages. The current structure of the Faith Nazarene school cafeteria makes it very easy to incorporate healthier food. While programs in the United States are forced to make changes through a long process due to the many laws and restrictions in the United States, Faith Nazarene school has the ability to serve food with only price, ease of preparation, and student preferences in mind. Since the school will be in charge of the cafeteria in the upcoming school year,

our group proposes, that the school make an effort to serve healthier food in general along with vegetables produced in the school garden.

Steps needed to garden for school lunches:

1. Identify a garden manager must be willing to take care of the garden. Perhaps one or two classes at Faith Nazarene can incorporate the garden in their class curriculum, while helping to manage the garden.
2. Identify healthy recipes the students will enjoy and the school can afford. Plant vegetables that will be used in such recipes to cut down on the cost and to increase student interest. A few recipes can be found in the Appendix 6 of this report.
3. Allow students to be involved in the harvesting and perhaps the preparation of the vegetables grown in the school gardens.
4. Keep the garden going all year. Utilize the knowledge of local gardeners to grow as much food as possible throughout the school year.

The lack of rules and regulations that Faith Nazarene needs to follow makes the connection between the garden and the school lunch program straightforward and easily delivered. Simply grow food and use it to feed students! Through our project at Faith Nazarene, we learned that the students in Mr. Humes' class had more knowledge and understanding of gardening than some children in the United States. Perhaps this is because Belizeans until recently maintained home gardens. The key is to get students excited about gardening, which was not hard with Mr. Humes' class, and perhaps the school garden at Faith Nazarene will encourage parents to begin gardening again.

Our group has identified some specific activities and ways of incorporating the school garden into healthy school lunches that can be successful at Faith Nazarene. Harvesting vegetables as a class activity and then using the vegetables in the school cafeteria is a beneficial lesson in healthy eating habits. For example, harvesting chaya and then serving a chaya dish for lunch helps students get excited about eating healthy. Harvesting carrots and serving carrot soup is another healthy meal and class activity option. The links in Appendix 8, as well as the recipes presented in Appendix 6, have many healthy recipes that can be made easily and inexpensively as a way to improve the health quality of the food served in the Faith Nazarene school cafeteria. However, it is important for Faith Nazarene to merge both new recipes and local preferences to ensure the students enjoy the new healthy food.

The garden can be incorporated into many aspects of the curriculum at Faith Nazarene. Science, math, history, and geography lessons can be developed incorporating the garden. For example, measuring the distance between plants is a great way to teach measuring units and how to accurately measure specific distances. Choosing a vegetable and learning its origins is an intriguing way to keep students interested in history. We hope that the new garden at Faith Nazarene will be used to diversify the curriculum and help students to understand that they have the ability to grow their own food and feed themselves (see Appendix 7 for garden layout sample).

Future Recommendations: Nutrition Curriculum

Since the garden has now been established at Faith Nazarene, the nutrition curriculum developed for this project can be better used to teach about and expose children to fresh, local foods and how to use them in their everyday diets. The foods planted in the garden will be the basis of the future curriculum developed at Faith Nazarene. Currently, tomatoes, lettuce, and radishes are planted in the raised beds on campus. This allows for teaching the students about the nutritional value of these foods as well as their role in certain meals.

Future curriculums should aim to develop lesson plans that incorporate cooking and preparing dishes that include these foods. This should be the focus of the lesson plans that will be developed after the vegetables grow and have been harvested. Using these three foods, teachers will be able to center lessons around preparing fresh salads and salsas. Since the average Belizean diet does not usually include salad or non-starchy meals, exposing students to how important vegetables and fresh salads are in everyday diets will be important.

Other foods that can also be planted in to garden beds that benefit the nutrition of the students include: carrots, herbs (like basil and cilantro), onions, peppers, and eggplant. All of these foods aid in lesson plans for nutrition that would be focused on including more fresh vegetables and fruits into students' diets. They will also help to teach children how to prepare fresh meals from local foods so that they can be inspired to do so at home with their families.

Overall, the future curriculums should be centered around those foods planted in the new raised garden beds. The lessons will serve to teach students about why certain foods are important in their diets nutritionally and how to prepare those foods in new and exciting ways. Cooking should be included in the lessons to show and allow children to taste new meals. Recipe booklets should be composed that allow the students to share their knowledge with their families so that they can make new and healthy meals at home. It is important for foods and supplies used to be carefully chosen to make sure that average Belizean families will be able to afford them. The goal of the nutrition curriculum is to provide students with knowledge about why food is important for their physical and mental well being and how to change their diets in simple ways to accomplish that goal.

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Appendices

Appendix 1: Literature Review

INTRODUCTION

There are necessary components to consider when creating a primary school curriculum for nutrition and gardening in a country such as Belize. You must consider how this kind of education is more interactive and hands-on when compared to the core curriculum. This kind of project also incorporates environmental education into the curriculum and requires teachers to link lessons to the cycles that appear in nature. When creating an educational garden, there are important considerations as to what plants can grow quickly in the area, what type of fertilizers will be used, and what kind of soil you will have to work with. From that, you must link the idea of gardening to nutrition education. To create the nutrition portion of the curriculum it is important to consider specific nutrition deficiencies present in Belize. This allows for understanding of what kind of nutritional problems can be remedied through change in diet. The overall goal of developing a nutrition and gardening curriculum for Belize, specifically, is to give children a chance to learn about local foods, how to grow them, how this pertains to taking care of the environment, and how changes in their diet can benefit their physical and mental health. This literature review will cover garden education techniques and considerations; an overview of gardening technicalities; and a profile of nutrition for Belize.

GARDEN EDUCATION

Gardening benefits children in many ways. When children garden, they are satisfying their curiosity while learning patience through watching the seeds grow and change. They are also learning hand-eye coordination by digging in the dirt and planting. Learning plant and insect names brings them closer to their natural environment.

To teach children gardening skills, there are a few essential elements. First, brainstorming ideas with the children and trying to incorporate everyone's ideas is a good way to get children excited about the project. Next, making sure that the plants chosen are success-ready and well suited for the soil without chemical pesticides and fertilizers being necessary is important for starting a new garden (Dorschner 2009). A good way of doing this is to use small cups for planting seeds and then move them into bigger, raised garden beds. This simultaneously allows for the children to get acquainted with the concepts of planting (Dorschner 2009).

An important consideration for garden education is to identify a garden structure. One structure idea is to divide one-foot squares with paths along the outsides and allow the kids to plant something different inside each square (Dorschner 2009). Another structure is a circle garden where the plot is divided into slices, "pie-fashion," with paths that should, generally, be at least two feet wide. While designing the garden's structure it is important to be aware of any power lines, septic systems, or other existing limitations. Adding fences or walls for privacy and to establish boundaries is important, as well as making sure that the materials used for this type of construction will not rot and will be able to withstand any "roughhousing" (Dorschner 2009).

For the teachers there are some considerations to take into account in order to establish a successful garden project. First, teachers should relax their standards and realize that imperfection in the garden is a part of the process. Teachers should “spend short, frequent periods for garden maintenance to maintain a casual and encouraging attitude” (Tilger 1975). Allowing kids to dig around and have fun is important to engage the students in the process. Making sure that children realize the benefits of some insects in the garden is also important so that they can see the interconnectedness of nature. Second, teachers need to understand that children will most likely be very enthusiastic in the beginning of the gardening project, but that same level of enthusiasm may not be sustained when planning curriculums (Tilger 1975). Third, being aware of different age levels is crucial for understanding what children are able to accomplish in the garden. Children ages eight through nine do well with designing gardens on graph paper and can translate drawings into becoming real gardens. Their ability to use tools is also better and safer at this age. For children ages ten to eleven, garden projects are able to cross several disciplines and incorporate science, math, and art (Dorschner 2009).

Garden education has benefits for helping children to better connect with and understand their environment. While planning a gardening project there are important considerations to be aware of in terms of teaching, garden structure, and what students are capable of comprehending at what age from such a project. The ability to make children more connected with their food, nutrition, and natural environment are all positive aspects of a garden project.

GROWING VEGETABLES ON A TIME LIMIT

Growing vegetables is exciting but harvesting is the reward for hard work and patience. When working with children it is necessary to present incentives for their hard work, with little time there are many options that will yield more vegetables quickly.

BBC (2008) provides a quick guide to vegetables that take little time and not much effort. Radishes are easy to grow, colorful and ready to harvest within a month of planting. Lettuce should sprout within twelve days of planting and only takes eight weeks to mature depending on the variety. Zucchini, also known as courgette, can be harvested within six weeks of planting but do require a lot of space to grow. Carrots will germinate within seventeen days of planting and are an exciting vegetable to harvest. Herbs add aroma and flavor to cooking and make eating healthy much more enticing. Parsley, oregano, basil and thyme are popular herbs that can be harvested within 8 weeks of planting (Yates, 2006). A variety of herbs and vegetables can be produced in less than two months, making gardening with limited time possible.

RAISED BED GARDENING WITH LIMITED SPACE

Raised bed gardening allows for vegetable gardens to be grown with limited space. Raised beds are areas built to support small areas of deep, loose soil, ideally six inches deep (Cox, C., & Jeavons, J. 1999). Raised beds allow for plants to form a deeper root base, allowing plants to require less water. Plants can be planted closer together (Bradley, 2004). The use of raised beds also allows for vegetables to be grown in 'square' formation rather than rows, resulting in more vegetables per area and less weeds due to increased ground cover (Bradley, 2004). Bradley (2004) and Cox, C., & Jeavons, J.

(1999) suggest that managing raised beds is easier than managing a traditional garden for limited space. Raised beds make weeding, watering, plant accessibility, sun protection, and pesticide administration less cumbersome as all areas of the garden are easily accessible. Raised beds are ideal for small vegetable production in areas with limited space.

ORGANIC SOIL TREATMENT THROUGH PH LEVEL

The PH level of soil is a very important factor to consider when growing vegetables. PH is the measure of acidity and alkalinity on a scale from 1 to 14, 1 being very acidic and 14 being extremely alkaline (Bradley, 2004). The PH level of soil is important because soil contains nitrogen, potassium, phosphorus, and other nutrients that are available to plants when the soil PH is at a certain level. For example, NASA (2004) explains that soil PH above 5.5 is required for plants to have access to the nitrogen in the soil and most vegetables grow well at a PH level between 5.5 and 7.

Testing soil PH is a simple process that can be done using an inexpensive test kit that matches samples with correct PH levels (Bradley, 2004). Once the PH level of soil is determined, it is easy to improve the soil, whether it is too acidic or contains too much alkaline. Soil that is too acidic and requires an increase in PH is treated through the addition of lime. Lime can be purchased inexpensively in the form of a chemical and added to the top of soil with water (Buchanan and Holmes, 2001). Lime is often ground stone and its effectiveness is increased with a decrease in particle size. Ontario (2002) explains that limestone is more effective in neutralizing acidity in soil when it is in powder form. Limestone powder has more surface area than limestone rock, allowing

the limestone powder to interact more with the soil, making it more effective. Along with chemical additives, soil PH can be increased through the use of powdered limestone.

Soil that contains too much alkaline can be improved through the addition of sulfur (Buchanan and Holmes, 2001). Calcium sulfate, gypsum, and other sulfur containing chemicals are used to reduce the alkalinity of soil in a fast acting manner (Wander and Andrews, 2009). Although these chemicals are fast acting, they must be added to soil every six months to a year (Buchanan and Holmes, 2001). Organic matter such as peat moss, mulch, composted leaves, composted sawdust, and pine needles are also used to lower soil PH. These methods take longer to change the soil PH; however they have long lasting effects and do not need to be used as frequently as chemical forms of sulfur (Buchanan and Holmes, 2001.)

Good soil is the foundation of a successful garden and it is important to improve soil quality when planting a garden. Other organic materials that are easily available are often used to improve soil quality. For example, cocoa shells improve soil quality as they are an excellent source of potassium. Adding seaweed, kelp, seed meal, manure and compost also diversifies the nutrients contained in the soil (Wander and Andrews, 2009).

NUTRITION STATUS OF BELIZE

Nutrition education in Belize has not been well organized and currently is not in practice. Food availability is not a problem for the country, however since a large percentage of Belizeans live in poverty they are prone to food insecurity, or lack of

access (Palacio 1997). The Belizean diet varies between different ethnicities and classes. These differences impact how and what people eat daily due to cultural traditions such as the Maya eating larger amounts of flour tortillas than the Garifuna, who prefer cassava bread (Morris 2009). Although there is no official national data for the nutritional status across Belize, there are some nutritional disorders that have been documented as most prevalent in the country (Palacio 1997).

The main nutritional concerns in Belize should focus on nutrition education since most of the nutritional problems come from poor nutrition in the diet. One survey showed that 6% of children less than 5 years were underweight (FAO 1999). Children in this state and age are vulnerable to nutritional disorders such as marasmus and kwashiorkor, which are both disorders that come from inadequate diet and food intake. There are also recordings of high vitamin A deficiency and anemia, an iron deficiency. Anemia was shown to be present in 19% of children two to eight years old and 52% among pregnant women. Vitamin A deficiency, based on serum retinol levels, was found in 24% of children two to eight years old (Palacio 1997). A study conducted among adults in 1995 indicated that obesity was a problem. From 1993 – 1996, cardiovascular diseases accounted for 30% of deaths. Heart disease was the leading cause of death for males and females (Belize 2001).

Although there is no standard, enforced nutrition program in the country there are many individual organizations attempting to educate local citizens. One such organization is the Cornerstone Foundation in Cayo District, which has established volunteer projects to incorporate educational programs about nutrition, poverty, water insecurity, and sanitation (Health in Belize). Plenty Belize is another organization located in the Toldedo District that is concerned with nutrition education. One focus of

this organization is a project called Garden-based Agriculture for Toledo's Environment (GATE), which focuses on establishing organic school gardens as a way to promote local sustainability and benefits to the environment. Another project is the Toledo District School Feeding Program (SFP), which aims at helping primary school students perform better in school by providing them with a hot lunch. Participating schools raise funds to buy food supplies or secure food donations, supply their kitchens with needed appliances and utensils, as well as provide volunteers to cook (Health in Belize). These programs are good examples of projects that are attempting to bring nutritional education into schools in Belize.

NUTRITIONAL VALUE OF VEGETABLES AND FRUITS

Iron deficiency is a major problem for Belizeans, teaching children which vegetables and fruits are high in vitamin A may help to prevent this problem.

Vegetables that are a good source of Vitamin A are carrots, collards, leaf lettuce, mustard greens, romaine lettuce, spinach, and tomatoes. Fruits that are a good source of vitamin A are cantaloupes, mangos, and watermelon.

Vitamin C is another important vitamin for children to be receiving. Vegetables that are a good source of Vitamin C are bell peppers, broccoli, cabbage (green), cauliflower, collards, green cauliflower, hot chili peppers, mustard greens, okra, onion, potato, radishes, red cabbage, rutabagas, spinach, summer squash, sweet potato, tomato, and yellow snap beans. Fruits that are a good source of Vitamin C are apricots, blackberries, cantaloupe, gooseberries, grapefruit, grapes, honeydew melon, kiwifruit, lemon, lime, orange, papaya, plum, prickly pears, tangerine, and watermelon.

Fiber is an important dietary supplement that aids digestion. Vegetables that are a good source of fiber are and available in Belize are corn, green beans, onion, potatoes, and spinach. Fruits that are a good source of fiber include, avocado, banana, dates, dried figs, kiwifruit, papaya, pear, prunes, and tangerines (Fruits and Vegetable Encyclopedia).

CONCLUSIONS

A nutrition curriculum in Belize is something that has not been officially created, but is something that is necessary for improving the Belizean diet. Incorporating gardening, environmental education, and nutrition education into one curriculum is a way for children to learn about the interconnectedness of food and the human body. Considerations should be taken before developing the curriculum in regards to local health problems/deficiencies and space available for gardening. While giving children appropriate tools and methods to grow their own foods at home, or at school, teachers can simultaneously show them how to eat from the Earth in a healthier manner.

Appendix 2: Pre-Quiz

1. What do plants need to grow?
2. Can insects help a garden?
3. What is compost?
4. Why do we eat fruits and vegetables?
5. Can you give the names of two fruits?
6. Can you give the names of two vegetables?
7. Which of the following is a fruit:

Pineapple OR Carrot

8. What is your favorite food?
9. What food do you not like?
10. What is your favorite healthy food?

11. Have you been to the market by the river in San Ignacio?

12. What is your favorite part of the market?

13. Have you ever seen a vegetable grow?

14. Do you like to play in the mud?

Appendix 3: Garden Lesson Plans Used

Lesson 1

- Objective: To get an understanding of students' prior knowledge of gardening and nutrition
- Activity: Quiz

Lesson 2

- Objective: To get seedlings planted
- Activity: Divide up students; teach them about how to plant their seeds

Lesson 3

- Objective: To get students to identify different vegetables as well as insects that are helpful or harmful in a garden. Another goal is to teach children about good places for gardens to grow
- Activity: Bug twister, vegetable matching, and a tour of campus

Lesson 4

- Objective: To teach students about the parts of a plant and how to identify a variety of different seeds
- Activity: Seed matching, plant part lecture

Lesson 5

- Objective: To teach students about raised beds and how to transplant the seedlings; to give them a sense of ownership over their seeds

- Activity: Use flash cards to teach students the sequence of transplanting seeds, and then have them put the flashcards in order. Have students decorate tags for their seedlings

Lesson 6

- Objective: Transplant the seeds
- Activity: Split students into groups and supervise the transplanting of the seedlings.

Lesson 7

- Objective: Celebrate the end of the program; see how much the students have learned
- Activity: Party, final quiz

Appendix 4: Nutrition Lesson Plans Used

Lesson 1

- Objective: Food Groups and Healthy Eating
- Activity: Lists and Drawings
 - Making Lists about Healthy Foods
 - Explain about Go, Whoa, & Slow Foods
 - Drawings Activity about Go, Slow, Whoa Foods

- Examples of Lists about Healthy Foods
 - Why is it good to try and eat healthy foods?
 - Makes body happy when all vitamins and minerals inside are balanced
 - Prevents diseases, or illnesses
 - Gives you energy to have fun and play!

Let's list some healthy habits of eating:

- Eating more fruits and vegetables instead of cookies and sweets
- Eating 3 balanced meals that contain fruits and vegetables
- Eating breakfast every morning

- Examples of Go, Whoa, and Slow Foods
 - Go foods = are foods that are low in sugar and high in vitamins and nutrients that make your bodies happy. You can eat these all the time.

Examples:

Fresh uncooked fruit

Fresh vegetables in salads

Grilled chicken

Yogurt or milk (good for your bones!)

Whole grain bread and BROWN rice

Slow foods = are foods that have more fat in them and should be eaten occasionally

Examples:

Vegetables in sauces

Fruits in syrups

White bread, white rice

Cheese

Whoa foods = foods that are HIGHEST in fats and sugars and should be eaten only on special occasions and not daily.

Examples:

French fries

Fried plantains

Cookies

Chips

Soda

Fried chicken

- Drawing Activity about Go, Slow, Whoa Foods
Identify the go, whoa, and slow foods you ate today by drawing them and circling them with a triangle if they are Go foods, circle if they are Whoa foods, and square if they are Slow foods
-

Lesson Plan 2

- Objective: Healthy Snacking & Review of Food Groups
- Activity: Discussion & Lists on Boards; Taste Test; Recipe Handout
Taste test foods from different food groups
- Examples of Lists to Make:

Why is eating healthy important?

- it makes your body and mind feel better
- it makes you not get sick
- it makes you able to do things you like to do, like play and run

What are some old snacks that you eat?

How about some new snack ideas you can try? From each section of pyramid

Vegetables:

Carrot sticks or celery

Cucumbers

Tomatoes

Dairy:

Yogurt

String cheese

Glass of skim milk

Fruits:

Bananas

Pineapples

Sweets:

Honey

Raisins

Grains:

Pretzels

Cereal

Meats and Beans/Protein:

Black beans

Pinto beans

Peanut butter

- Activity Taste Test:

Rotate groups of 10 students each around each station allowing them to taste and identify which foods they liked and which foods they disliked.

Fruit cups (pineapple, watermelon, banana)

Oatmeal with honey and raisins and cinnamon

Peanut butter and carrot sticks

Yogurt

Appendix 5: Recipe Handout

Recipe Handout

New Healthy Snack Ideas!

Remember the different Food Groups when making healthy snacks and your body will thank you!

Vegetables and Peanut Butter

Ingredients:

- Carrots
- Celery
- 2 tbsp. of Peanut Butter (preferably local Belizean Peanut Butter)
- Box of Raisins (optional)

Preparation:

1. Cut the carrots and celery into thin slices/sticks.
2. Scoop peanut butter with knife and spread a thin amount across the sticks of celery and carrots.
3. Place 4 raisins on top of peanut butter on each stick.
4. ENJOY!

This recipe includes the following food groups:

- Vegetables
- Sweets (raisins)
- Meats/Beans/Proteins (peanut butter)

Yogurt and Fruit Cup

Ingredients:

- Pineapple
- 1 Banana
- Any other fruit of choice!
- 1 cup of Low-fat yogurt

- ½ cup of Cereal, such as Bran Flakes (optional)

Preparation:

1. Carefully, cut banana, pineapple, and other fruits into small slices.
2. Scoop 1 cup of yogurt into a bowl.
3. Place cut fruit on top of yogurt and mix together.
4. Optional: add in Bran Flakes for a crunchy treat.
5. ENJOY!

This recipe includes the following food groups:

- Fruits
- Grains (Bran Flakes Cereal)
- Dairy (yogurt)

Salsa & Vegetable Sticks

Ingredients:

- Carrots, cut up into sticks
- Cucumbers, cut into slices
- Tomatoes, diced
- Onions, chopped
- Cilantro, chopped
- Canned whole kernel corn
- Hot pepper (optional)
- Black beans, cooked
- Salt and Pepper

Preparation:

1. Mix together tomatoes, onions, cilantro, corn, black beans, and hot pepper in a bowl. Add salt and pepper.
2. Use the sliced cucumber and carrots to dip.
3. ENJOY!

This recipe includes the following food groups:

- Vegetables

- Meats/Beans/Proteins

Cheese, Apples, and Pretzel Snack

Ingredients:

- 12 Pretzels
- String Cheese or 3 slices of cheese
- 1 Apple, cut into slices

Preparation:

1. Place pretzels and apple slices on plate.
2. Cut up thin slices of cheese or use 1 stick of string cheese.
3. Eat together and ENJOY!

This recipe includes the following food groups:

- Fruits
- Dairy
- Grains

Banana Honey Smoothie

Ingredients:

- Banana cut up into slices
- 1 tbsp Honey
- ½ cup skim milk OR low-fat yogurt

Preparation:

1. If using milk, blend all ingredients together in blender.
2. If using yogurt: mash banana with fork, add honey, mix together with yogurt.
3. ENJOY!

This recipe includes the following food groups:

- Dairy
- Sweets (honey)
- Fruit

Trail Mix Snack

Ingredients:

- 1 cup cereal (such as Chex, or Bran Flakes)
- ½ cup pretzels
- ½ package of M&M's
- ¼ cup raisins or other dried fruit
- 1 apple cut into small slices (optional)

Preparation:

1. Mix together all ingredients in bowl and scoop into cups or plastic bag to take on-the-go!
2. ENJOY!

This recipe includes the following food groups:

- Grains
- Sweets (M&M's, raisins)
- Fruit

Pasta Salad with Vegetables

Ingredients:

- 1 cup cooked pasta (shells, penne, or ziti are good)
- 2 Bell Peppers, chopped
- 1 Onion, chopped
- Broccoli, chopped
- Plain Yogurt
- Cooked Shrimp (optional)
- Salt and pepper and a little lime juice
- Chopped garlic

Preparation:

1. Cook shrimp and pasta separately and let cool.
2. Mix shrimp, pasta, bell peppers, onion, broccoli and chopped garlic together.

3. Mix in plain yogurt (a GREAT, healthy substitute for mayonnaise) Add salt and pepper.
4. Chill in refrigerator for about a hour.
5. Serve and ENJOY!

This recipe includes the following food groups:

- Dairy (plain yogurt)
- Vegetables
- Meat/Beans/Protein (shrimp)

Other Simple Healthy Snack Ideas

- Cereal with skim milk
- Fruit with Belizean peanut butter
- Pretzels and Oranges
- Low-fat yogurt with fruit and honey
- Cucumbers with bean dip/refried beans
- Dry cereal with apple slices

Appendix 6: Recipes for Garden to School Cafeteria

Banana Bread

Yield: Eight Servings

Ingredients	
3/4 cup	Cake flour
1/2 cup	Granulated Sugar
1/4 tsp.	Baking powder
1/4 tsp.	Baking soda
1/4 tsp.	Salt
1/4 cup	Non-fat yogurt
1/4 cup	Sour cream
1	Large egg
2 Tbsp	Unsalted butter
1/4 tsp.	Vanilla extract
1/4 cup	All-purpose flour
1	Banana, medium, mashed
1/4 tsp.	Ground cinnamon
1/8 tsp.	Ground cloves

Nutrition Facts	
Total Calories	154
Calories from Fat	40
Total Fat	4g
Saturated Fat	3g
Cholesterol	29mg
Sodium	139mg
Carbohydrates	27g

Fiber	0g
Sugar	12g
Protein	2g

1. Preheat oven to 350-degrees.
2. Sift together the flours, baking powder, and baking soda and set aside.
3. Cream sugar, yogurt, sour cream, butter, salt, and spices together in a mixer using the paddle attachment.
4. Add eggs, one at a time, scraping the bowl down between additions.
5. When the eggs are fully incorporated add small amounts of the sifted dry ingredients, mixing well between additions.
6. Finish by adding flour and mashed bananas. Do not to over mix or the bread will be dense and heavy.
7. Put into a standard bread pan and bake for 30 - 40 minutes. Use a toothpick to test for doneness. Allow to cool before slicing.

Basic Tomato Sauce

Yield: Eight servings

Ingredients	
3-1/2 cups	Diced tomatoes, canned
4-1/2 tsp	onion, small dice
1 clove	garlic minced
1 tsp	extra virgin olive oil
1-1/2 tsp	fresh oregano, chopped
1-1/2 tsp	fresh basil, chiffonade
1/2	bay leaf

Nutrition Facts	
Total Calories	38
Calories from Fat	5
Total Fat	1g
Saturated Fat	0g
Cholesterol	0mg

Sodium	237mg
Carbohydrates	7g
Fiber	2g
Sugar	4g
Protein	1g

1. Over medium-low heat sweat the onion and garlic in olive oil until translucent.
2. Add diced tomatoes and bay leaf and simmer until flavors are blended.
3. Stir in oregano and basil, this sauce may be served as is or pureed, whichever you prefer.

Baked Pasta with Tomato and Ricotta

This is a recipe that all the kids seem to love. This can be set up the night before or in the morning and baked just prior to mealtime. Leftovers are great! We often add sautéed vegetables to this dish. In the spring try mushrooms and fresh greens. Later in the season zucchini and summer squash make tasty additions.

Yield: Eight servings

Ingredients	
1 lb	any dry variety of pasta
2-1/2 cups	Basic Tomato Sauce (for recipe click here)
1/2 cup	ricotta cheese
1	egg, beaten
1 Tbsp	parmesan cheese, grated
1 Tbsp	mozzarella cheese, grated
1 tsp	salt
1/2 tsp	ground black pepper
Nutrition Facts	
Total Calories	375
Calories from Fat	24
Total Fat	3g

Saturated Fat	1g
Cholesterol	22mg
Sodium	595mg
Carbohydrates	48g
Fiber	4g
Sugar	7g
Protein	11g

1. Cook pasta very al dente.
2. Preheat oven to 350 degrees F.
3. Blend ricotta, parmesan, beaten egg, salt, and pepper. The mixture should be loose and easy to scoop. If it is too firm add an additional egg.
4. In a Pyrex dish layer the sauce, pasta, and ricotta twice. Top casserole with grated mozzarella and parmesan. Bake for 20 minutes.

Fruit Smoothie

Smoothies, the healthy alternative to milkshakes. As an after school snack these will be a big hit. They make a great breakfast beverage as well.

Yield: Eight servings

Ingredients	
3	bananas
1-1/2 cups	pineapple, chopped
1-1/2 cups	orange juice
1-1/2 cups	nonfat yogurt
16-18	ice cubes
1/4 cup	honey

Nutrition Facts	
Total Calories	142
Calories from Fat	0
Total Fat	0g

Saturated Fat	0g
Cholesterol	0mg
Sodium	30mg
Carbohydrates	34g
Fiber	2g
Sugar	22g
Protein	2g

1. Put all ingredients in a blender and process until smooth. Serve.

Chile Cornbread

This cornbread recipe can be a snack, a side to chili, or even part of a balanced breakfast. Sweet pepper jam or jelly make great alternatives to butter.

Yield: Nine servings

Ingredients	
1/2 cup	yellow cornmeal
1/4 cup	all purpose flour
1/3 cup	cake flour
1 Tbsp + 1-1/2 tsp	white corn flour
2 Tbsp	sugar
1 tsp	baking powder
1/2 tsp	salt
2 Tbsp + 3/4 tsp	milk
1/4 cup + 2 Tbsp	buttermilk
5 Tbsp	unsalted butter
1	large egg, beaten

1/4 cup	fresh corn kernels
2 Tbsp + 1-1/2 tsp	green chili pepper, roasted and roughly chopped

Nutrition Facts	
Total Calories	123
Calories from Fat	60
Total Fat	7g
Saturated Fat	4g
Cholesterol	33mg
Sodium	67mg
Carbohydrates	14g
Fiber	1g
Sugar	3g
Protein	1g

1. Preheat oven to 350 degrees F. Grease 6 X 6 inch pan.
2. Melt butter and cool
3. Combine corn meal, flours, sugar, baking powder, and salt in a medium sized bowl and set aside.
4. In another bowl, combine milk, buttermilk, butter, and egg and blend thoroughly. Add liquid ingredients to dry ingredients and mix well.
5. Pour batter into prepared pan and bake for 20 to 30 minutes or until a toothpick comes out clean. Cut into 2 inch squares and serve. The cornbread can be stored at room temperature in an airtight container for up to 3 days.

Guacamole with Baked Tortilla Chips

Yield: Eight servings

Ingredients	
2	avocados, very ripe
1/3 cup	red onion, small dice
2 tsp	lime juice
1 Tbsp	jalapeno pepper, small dice

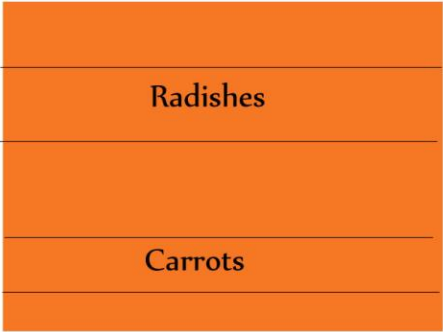
3 Tbsp	fresh cilantro, chopped
1/4 cup	tomatoes, small dice
1/2 tsp	salt
1/8 tsp	ground black pepper
10	8-inch tortillas

Nutrition Facts	
Total Calories	167
Calories from Fat	31
Total Fat	4g
Saturated Fat	1g
Cholesterol	0mg
Sodium	462mg
Carbohydrates	30g
Fiber	0g
Sugar	0g
Protein	5g

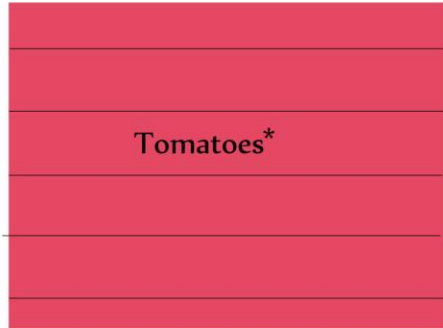
1. For the tortilla chips, preheat the oven to 350 degrees F.
2. Cut tortillas into triangles, strips, or any shape your kids like, and bake until crisp.
3. Pit and scoop the avocados. Using a potato masher or a fork, mash them in a small bowl.
4. Mix in the onions, jalapeno pepper, tomatoes, and cilantro.
5. Season with lime juice, salt, and pepper.

Appendix 7: Layout for Raised Beds

Faith Nazarene Garden Beds



Three Sisters
Corn
Squash
Beans



Appendix 8: Helpful Resources

One of the first programs that incorporate gardens and school lunches in Berkeley, California.

<http://www.school lunch initiative.org/>

<http://www.edibleschoolyard.org/>

Healthy recipes for corn, squash, and beans.

<http://www.hort.cornell.edu/gbl/planting/3sisterscooking.pdf>

Guide to how to start a kids gardening project.

<http://www.hort.cornell.edu/gbl/pubs/sowingseeds.pdf>

Guide to Garden in the City: Ideal for San Ignacio Town

<http://ecommons.library.cornell.edu/handle/1813/3628>

Several publications on how to garden in schools.

<http://www.hort.cornell.edu/gbl/pubs/index.html>

Sample calendars of school lunch menus.

<http://www.school lunch initiative.org/menus/calendars.shtml>

Gardening Lessons and Activities

<http://www.kidsgardening.com/>

Garden based learning

<http://www.lifelab.org/>

Guide to school garden based lessons and activities.

<http://www.schoolgardenwizard.org/>

Appendix 9: Follow-Up Quiz

Follow Up Quiz:

1. What insects HELP the garden?
2. What insects HARM the garden?
3. What do plants need to grow?
4. What is a healthy snack that you tried in class?
5. What healthy foods do you eat at home?
6. What was a problem you had with your plant?