Middle School Student Attitudes Towards Garden Based Learning: A Case Study at Park Middle School

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MIDDLE SCHOOL STUDENT ATTITUDES TOWARDS GARDEN BASED LEARNING: A CASE STUDY AT PARK MIDDLE SCHOOL

Jake Arneson

AN UNDERGRADUATE THESIS

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Abstract

A case study was performed at a middle school in Lincoln Nebraska. The study centered around how to effectively implement an after school garden program through the Boys and Girls club on site at the school. The first year of the study showed low attendance numbers. The second year of the study recorded participation frequencies of individual students and gathered attitude assessments. The assessments were then matched with the participation frequencies in order to determine reasons for attending or not attending. The study found that social aspects and a feeling of importance of knowing how one grows and obtains food influences attendance.
Acknowledgements

This project was only possible with the help of several important individuals. Thanks to Lisa Pennisi, my thesis advisor, who provided for me templates for attitude assessments as well as offered ideas, advice, and edits. Thanks to the UNL garden gang and environmental science advisor, Sara Cooper, who helped in gathering ideas and materials for the project as well.

Finally, thanks to the boys and girls club and Park middle school for their support in allowing me to do this project. A special thanks to Brent Doctor, Boys and Girls club program director, who helped me in every aspect of running the garden club at the school.
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Environmental education is not a required part of middle school curriculum in the United States. Although students are required to take science classes in middle school, the teachers are not required to incorporate material into the classroom instruction or work that highlights current environmental problems and solutions. As the window for preserving our environment and resources is dwindling, and at a time when new environmental problems are becoming increasingly salient, it is becoming more and more important that the youth understand the problems they are inheriting and what sort of changes need to be made. Furthermore, since there is no required curriculum in elementary schools, environmental education needs to be devised and implemented immediately in order that we waste no more time in educating the political participants of our future.

Environmental education curriculums currently exist, but the education is most effective in shaping attitudes earlier in a student’s life. A model needs to be developed that can engage middle school students, who are past the age were the world is new and full of wonder, and have moved to a more independent technologically saturated phase of their life. The purpose of my research is to identify potential reasons/incentives for participating or not participating in an after school environmental education program.

In 2010, the National Environmental Literacy counsel performed a study whereby they collected data from 48 counties in the United States concerning the understanding and attitudes of students hold towards environmental education. They created a numerical scale by which the students could “score” based on a questionnaire they were given. The students scored a 39% in so far as their understanding of environmental principles, which relatively speaking is rather low.
However, the students scored 70-81% in the study’s assessment of the student’s attitudes towards learning about the environment (Mcbeth et al 2010). In other words, the students showed a strong desire towards being educated about the environment. As is apparent with the statistics, a dichotomy exists between how much children know, and how much they are willing to learn. This provides further gravity towards the legitimacy and need for research concerning implementing effective environmental education programs.

An important component of effective teaching is the context and setting in which the information is presented. I propose that a more effective way of teaching environmental based information is beyond the walls of a classroom in an outdoor setting. There is a wealth of literature that highlights the importance and effectiveness of presenting certain types of information in a more natural setting than a classroom. In the book The Inclusion of environmental Education in Science Teacher education by Bodzen et al, educators are encouraged to see the garden as an extension of the classroom. The book describes the benefits of this sort of “place based education” and how the surroundings of a school building can be turned into a teaching laboratory (Bodzen et al 2010).

In the article Closing the achievement gap: Using the environment as a integrating context for learning, researchers identified that incorporating outdoor learning into school curriculum fosters “higher levels of interest, enthusiasm, and engagement in learning activities; better attendance and fewer disciplinary referrals; and higher achievement, as measured by standardized test scores and GPAs.” The article goes on to argue that “using the outdoors as a vehicle for instruction sparks students’ enthusiasm and interest in academic activities, which may in turn promote their learning in school.” (Lieberman, G., & Hoody, L. 1998).
Gardens on school grounds serve as an outdoor classroom and can be used to increase environmental attitudes and awareness of environmental issues among students. The practice of horticulture itself in schools aids in improving retention of scientific principles and fostering environmental attitudes. An article published in the *Journal of Environmental Horticulture: School Gardening: Improving Environmental Attitudes of Children through Hands-On Learning* highlights horticulture as the most hands on learning-based type of science education. Furthermore, the study concluded that participating in garden activities results in students gaining more positive attitudes about environmental issues. (Waliczek and Zajicek 1999).

**History of school gardens:**

Gardens and garden projects have been built on the sites of schools throughout the history of our country. In 1890, the First official US school garden was created at George Putnam School of Roxbury, Massachusetts primarily for the growth of wildflowers and vegetables (Miller, L. K. 1908). Early on in the history of the country, gardens were used primarily for teaching students about how to produce their own food, being as this was one of the main career opportunities at one point in the history of our country and installing principles of “hard work.” (Miller, L.K. 1908). The aim was to incorporate an agronomic form of teaching into the regular form of education. In the BULLETIN, 1919, No. 26 produced by the Bureau of Education within the Department of the Interior, J Francis discusses the birth of the United States School garden Army which was created out of the demand for food production created by the conditions of the First World War. The bulletin goes on to explain how President Wilson appropriated $50,000 from the national security and defense fund to encourage “gardening among school children of America in residing cities, towns, and villages.” This program showed a large degree of success with 1,500,000 boys and girls enlisted in the “army” and 20,000 acres
converted into public lands for agriculture. 50,000 teachers were educated at the time in how to teach gardening principles by way of instruction through leaflets (J.H. Francis, 1919 p3).

The book *Children’s Gardens for School and Home, a Manual of Cooperative Learning* by Louis Klein Miller 1904 highlights the rise of the school gardening movement in the United States. The book argues that garden based education doesn’t necessarily represent an entirely new way of presenting education but rather an old way, that is “gaining merit” due to its ability to address a wide variety of problems and needs. She argues that movement possessed primarily two motives: to transform more barren landscapes of school yards into places of “aesthetic” bounty and also to instill in children a respect and love for nature as well as an understanding of how it operates (Miller, L.K. 1908). After World War II, the emphasis on localized gardening faltered due to the stigma carried by victory gardens being associated with times of economic ills. As we currently experience a period of much economic uncertainty, the notion of school and community gardens is becoming increasingly important. However, there have been efforts to increase this sort of education more recently. The *ABC’s of environmental education* a book written and published by the EPA, discusses the history of environmental education in the United States, citing the passage of the Environmental Education Act in 1990. The language of this act serves to increase the federal government’s role in environmental education and increases partnerships through different sectors of the government. It also discusses the National Environmental Education grant program as well as training programs for educators. Thus, the federal government has been involved but the projects more recently individuals and organizations have been spreading school garden projects across the country (EPA 1994). At the University of Nebraska Lincoln, there is a group called the Garden Gang that I am a part of and doing my project through that assembles donations, lessons and tools for garden based education.
My project aims at developing a horticulture based garden program at Park Middle School intended to increase environmental attitudes as well as environmental science knowledge. The program is executed through the Boys and Girls club afterschool program, and my research aims specifically at mapping participation and assessing student attitudes towards the program with the intent to increase participation and club membership in order to improve and model the program so that it may be successful over the long term. In 1992 at the United Nations Conference on Environment and Development objectives were laid out concerning what must be considered and included in environmental education. The five objectives considered to be of upmost importance were awareness, knowledge, affect (the education must affect the students’ lives), skills, and participation. My research focuses more specifically on the aspect of participation.

**Benefits of School gardens.**

More recent research and literature has been published that addresses the many potential benefits of school gardens. Michael Pollen’s book *a second Nature: Gardener’s education* is essentially based upon the idea that through the gardening experience one can find principles of scientific education. An article published in the Journal of Children’s environments, *Childhood's Garden: Memory and Meaning of Gardens*, Mark Francis highlights the strong conceptual meanings people attach to gardens. The article suggests that there is a role in child development and place attachment in youth gardening. By interviewing gardeners in California and Norway, Francis identified that garden experiences serve as long lasting memories for many of the respondents. The study goes on to suggest that the information that children can potentially learn in a garden setting would stay with them over time in the form of a “place based memory” (Francis, M. 1995).
Horticultural practices are increasingly being used to improve environmental attitudes towards specific environmental issues in school curriculum. A horticulture graduate student at the University of Louisiana, Kathryn Karsch, used horticulture in order to teach students how to preserve coastland areas and the flora species that were becoming increasingly threatened by urban expansion and development. She states in her thesis that the most difficult level to teach science, and more particularly environmental science, is at the middle school level. Karsch notes horticulture as a possible solution to engaging students in science education because of its more activity based approach. She taught eight lessons at four schools over the course of four years. The Results she obtained for both 2003 and 2004 showed general science knowledge increased in students an average greater than 20%. Long and short-term memory test indicated individual higher scores for the students who were instructed in this program compared to the control students. Her results also indicated a significant increase in environmental awareness in participating students (Karsch, Kathryn 2003). Thus, her results showed gardening as an effective tool at the middle school level.

Another study by R.W Clarke *Curriculum integration and ornamental horticulture* showed horticulture as an effective hands on tool for teaching scientific principles. However, he found that teacher training in horticulture was necessary in order that they confidently and effectively incorporate the information. (Clark, R.W. 1994). This study suggests that it may be necessary for a third party with horticultural training to present the horticulture based education. Horticulture and furthermore gardening serve as an effective medium for teaching environmental science education.
History of the Project/Case study:

In January of 2011 I met with the principal of Park Middle School on 7th and F. Park middle school is a largely low income, and ethnically diverse middle school located in an area of town that has historically been an immigrant neighborhood. The neighborhood was originally started by German immigrants who settled in the Russian empire, known collectively as the “Germans from Russia” who settled into the neighborhood to work the railroads. The student body is composed of individuals whose cultural backgrounds are rooted all over the world. Built in 1926, renovated in 1991, Lincoln Public Schools lists Park middle school as one of the most diverse middle schools in Lincoln. As one enters the building it is noted that Russian, Arabic, Spanish, and English adorn the bathroom signs indicating a high level of diversity. The school places a large emphasis on multiculturalism and multiple intelligence, or rather incorporating multiple forms of learning. The school has a student body of 670 students grades 6-8, 59% minority students, 10% gifted students, 18% English language learners, 18% special education, with 73% of students being eligible for free/reduced meals. I find the school to be an appropriate site to introduce my project because of the diversity inherent in the student body. For a model of environmental education to be successful it must be adaptable to any sort of student population.

Garden based education can provide very beneficial for urban schools here in Nebraska. A study performed by Karyn Lane and Susan Fritz in 2000: *Environmental Science in Rural and Urban Elementary Programs of Nebraska* assessed the amount of environmental education that was being presented in both rural and urban schools in Nebraska. The study found that rural elementary teachers reported teaching some environmental topics significantly more frequently than urban elementary teachers. (Lane, K et Fritz, S. 2000). My project is then necessary as an attempt to bridge the gap between rural and urban environmental education. Another study
performed by Jrene Rahm: *Is that really science? A look at the Science Practice of an Inner-City Youth Gardening Program* found that for children, particularly in inner-city areas, gardening provided “opportunities to gather much factual and practical science knowledge that was very context-specific” and concludes that “an appreciation for and awareness of the natural world, two important components of scientific literacy, could be developed through garden work.” (Rahm, Jrene 1999). Studies have also shown that a gardening program on school grounds can impact career choices as well as environmental attitudes. The study argues that the experiences in school gardens can help students understand the potential job opportunities in the nursery industry that they may not have been aware of. (Rahm, Jrene 1999). The program has potential to provide incentive for post high-school scientific study in the horticulture field. At a school where the majority of students are from immigrant families, in many cases the students are set to be first generation college students. A project such as this may provide opportunities to the students that were not necessarily visible.

The Boys and Girls club does not have an overreaching garden program built into its mission statement, however there are many Garden clubs existing in many cities at the various Club sites. The cities of Grand Rapids, Annapolis, and Orange County have garden programs that have been highly successful and have received a large amount of media and public attention and support. Many of these programs have a paid personal that runs the club and receives funding and support directly from the club. One intention of my project is that in the future the Boys and Girls club in Lincoln will have a school garden program as evolved as ones in other parts of the country. A garden program at a school such as this one may be effective and necessary on many levels.
Upon contacting the principle I was referred to the coordinator of the boys and girls club after school program Brent Doctor. The principle felt the program would be most successful if it were run through the boys and girls club. As much as I enjoyed the opportunity to work with the boys and girls club, this effectively cut me off from much direct communication with the school. The Boys and Girls club at Park Middle School is the only Boys and Girls Club in Lincoln. The club is essentially an afterschool program usually located in inner city regions. The boys and girls club website explains itself as “a safe place to learn and grow – all while having fun. It is the place where great futures are started each and every day.” The mission statement of the organization is as follows. “In every community, boys and girls are left to find their own recreation and companionship in the streets. An increasing number of children are at home with no adult care or supervision. Young people need to know that someone cares about them. Boys & Girls Clubs offer that and more. Club programs and services promote and enhance the development of boys and girls by instilling a sense of competence, usefulness, belonging and influence.”

Upon meeting Brent Doctor, head of the Boys and Girls club, we found that we both had the same desire to implement an environmental education club at the school, and decided it would be most effective to do it through a garden club. Gardening is an outdoor activity that is generally attractive to middle schoolers because it yields results more than flower, namely food. As previously mentioned, many principles of the natural world then can be communicated using the garden as a lab/platform.

In the spring of April, the club began meeting on Wednesdays in the outdoor courtyards at Park. We spent the first part starting seedlings and cleaning up the beds. We mulched the
entire area and basically restored these courtyards that had been neglected for years. At each club meeting we would engage in a different activity in the horticultural field, engaging in a variety of activities from propagating (cloning) soft tissue cuttings to planting and maintaining a garden. I was able to secure a spot for the school in a community garden up the street at 9th and D. Using plants donated from Earl May, a vegetable garden was planted there as well as on site at the school. At various times we would take field trips up to the plot and use it as an axillary teaching station. This site was necessary due to the fact that the school was only allowing cultivation of areas in primarily shade. However, it proved difficult to maintain good behavior on a foreign site where the support of the regular staff authority was largely absent. Although the work was fruitful the club proved to yield much less in so far as garnering participation. The “members” of the club were constantly fluctuating. Some days I would have ten people show up to the club and some days I would only have one. The only constant member I had was a five year old girl named Sharron, who lived in the neighborhood. Although Sharon thoroughly enjoyed the experience and retained enough information from the activities that I would consider the work worthwhile, she was not even in kindergarten. The middle school kids, when they did come would engage and did show interest, however they were usually more concerned with occupying their after school time with more social activities. I derived from my experiences there that the students were very concerned with who was going to garden club. If one of my more enthused members chose to go on any particular day, they almost always had two to three friends who would come as well. It seemed that social factors played a large part in attendance.

The fall of 2011 I decided to put the club at Park on hold with the plans of developing a better program for the following spring. I began running the program that already existed at Saratoga, an elementary school. I had no problems with membership in this program. At each
club meeting I would have around ten members who consistently came, as well as fluctuating numbers on top of that. From my experiences with the Saratoga program as well as the success I had with Sharon the five year old at Park, I realized there was a strong difference between the junior high and elementary membership in a garden club. Nearing the conclusion of the summer club season I performed candid interviews with many of the students in order to identify potential reasons for attending or not attending garden club. The reasons fell essentially into four categories:

1. Apprehensions or incentives based on the social aspect of the club (not cool or not for boys).

2. Difficulties with club infrastructure (time of club and when parents pick them up or whether or not other clubs and field trips were going on at the same time)

3. Enjoyment of the outdoors and

4. Whether or not students deemed it important to know how to grow food.

From the experiences I had with these case studies I decided to focus my research on assessing student attitudes towards the club, and matching these attitudes with participation to see if I could identify reasons for attendance, and improve the club accordingly. The goal of the project came to be to build an onsite garden learning center from entirely free and donated materials. The goal of the project was to develop a model that was a.) easily reproducible, b.) effective in communicating horticultural ideas, and c.) free or very low cost to enact. Beyond building the program, my goal was to ultimately improve attendance and participation in the club through attitude assessments and recording individual participation frequency.
Methods and Materials

For the second year of this project, the principle finally allowed the club a permanent undeveloped space on site that received more light in order to expand the program. An eight foot by four foot raised bed was constructed on site, using materials that were entirely donated using the website http://www.freecycle.org. The website serves as a resource for acquiring free materials. I posted on there that I was in need of wood for a raised bed at Park middle school and I immediately received a response and was donated ten twelve foot 2x4s and one seven foot 4x4. The 4x4 was cut into four equal lengths and used as posts to which 2x4s were attached. The bed was then filled with topsoil donated from general excavating and compost received for free from the city dump. Seeds donated from Seed Saver’s exchange were started in my basement as well as planted on site. Ten varieties of tomato plants and ten varieties of pepper plants were started indoors. Flowers, cucumbers, corn, and various other vegetables are to be started beside the bed in order to improve the aesthetics of the area as well as the productivity.

In order to increase the educational emphasis of the program, I also developed seven lesson plans as well as a set of objectives for each lesson in order to satisfy my goal of easy reproducibility of the lessons for future individuals that may lead the club. The lesson plans were developed based on labs from the UNL horticulture department. With the assistance from the teacher assistant, I received lesson plans from the Intro to Horticulture labs and the Intro to Plant Propagation labs. The lesson plans and objectives were modified using Colorado State University resources for lesson plan objectives and the Natural Gardening Association’s garden based learning projects "Rebel Tomato" which is a website constructed by the American Community Gardening Association and funded by the U.S. department of Agriculture. The resource offers activity suggestions for five different categories from which to base place-garden
learning: Seeds, Roots, Shoots, Fruits, and Harvest. This educational framework was then worked into each lesson plan to address the five categories necessary to the completion of the garden education. The lesson plans were composed of both an educational instruction/lecture based component and an activity relevant to the lesson. In each lesson plan there is a PowerPoint presentation of the material relevant to each lesson, and each of the objective sets provided the purpose of the activity, a how to perform the activities, the materials required and relevant methods, as well as a verbal quiz in order to determine the effective retention of the information addressed in the slides.

In order to mark the attendance and to identify trends concerning attendance, an attitude assessment was created using a format provided by the College of Agriculture and Natural Resources faculty member Lisa Pennisi. The attitude assessment included ten questions geared towards identifying trends for participating based on the four categories for potential attendance identified from the interviews conducted the year prior. The attitude assessment is shown in Figure 1. Twenty attitude assessments were then given to Brent Doctor, head of the Boys and Girls club, and he distributed these among students who had shown him potential interest in gardening. Sixteen students agreed to participate and filled out the surveys. The answers to their surveys were recorded and then the attendance frequency of each student was recorded in order to determine any sort of relationship between attendance and attitudes.
Results:

Of the respondents who filled out the assessment 85% of respondents agreed to strongly agreed to the questions indicating importance of outdoor learning. 65% of students agreed to strongly agreed to the questions concerning enjoyment of outdoor learning/gardening. 62% of students agreed to strongly agreed to the questions concerning the social aspect of gardening club influencing attendance. 50% of students agreed to strongly agreed to questions concerning the infrastructure of the Boys and Girls club influencing attendance. Of the sixteen potential garden club members only 4 members participated in the club more than once: Yatzel, Mari, Yuri and Reggie. 100% of these four agreed to strongly agreed concerning the importance of outdoor learning 83% agreed to strongly agreed concerning friends influencing attendance. Two students of the four showed a 100% attendance rate: Mari and Reggie. The Students agreed to strongly agreed 100% concerning importance of outdoor learning. The two students responded with a 66% agree to strongly agree to questions concerning importance of friends on garden club attendance. Of the 12 students who did not attend 62% responded agree to strongly agreed concerning the social aspect affecting garden club. 41% agreed to strongly agreed to the importance of knowing where their food comes from and how to produce it. 63% responded agree to strongly agree to questions concerning infrastructure influencing, and 60% responded agree to strongly agree concerning questions of enjoying outdoor based learning. These percentages are represented in Table III. Individual responses to each of these questions can be seen in table I. Table II shows the frequency of the type of responses for each question. 1s and 2s show agree to strongly agree 3s, undecided and 4s and 5s show disagree to strong disagree. 1s and 2s are strongly agree and agree, 3s undecided, and responses of 4s and 5s show disagree to strongly disagree.
Discussion:

The attitude assessment did show that the students carried strong attitudes towards the importance of knowing where food comes from and how to produce it overall. These results are in line with the study by the National Environmental Literacy Council in 2010 which indicated the want inherent in students to ascertain environmental education. Of the students who didn’t participate, only the responses of 41% reflected attitudes that considered it important to understand food production. Since of the students that did participate 100% agreed to strongly agreed that it was important to know where one’s food comes from, and 41% of the ones that didn’t participate agreed to strongly agreed to this importance, it may be concluded based on this sample size that an importance of knowing where ones food comes from strongly influences attendance. 63% of students that never attended indicated the infrastructure of the club affecting participation while only 50% of the students that did participate indicating this being a factor. Therefore, a weak but existing relationship is shown between participation and infrastructure influencing attendance. Among the students who did participate in the club, the assessment did reflect attitudes concerning friends/social aspect influencing club attendance. However, with such low attendance rates so far that it would be difficult to determine trends based this data alone. The results didn’t link the social aspects, enjoyment factors, or infrastructure factors very strongly to attendance rates as a whole, although responses indicated that these factors did play in to attendance for some at the individual level. Ultimately, the program still has many sessions in which increased participation and attendance will most likely be seen. I base this on the fact that attendance and enthusiasm as well as school support has greatly increased from last year. The first year the only support I received from the school, was a grant for garden tools, and this year I have received personal support from the principle as well as teachers that had no part in
the project the year prior. Thus, as the club continues the number of individuals who do attend and the frequency they attend will contribute to the overall understanding of what influences students to come or not to come to the club, in this case study at Park.

Conclusions:

The Boys and Girls clubs in most major cities have been generally more successful in establishing the club which may be attributed to the fact that they are often ran by onsite members and not an outside party. Student/instructor familiarity and relationship may have more to do with attendance than personal attitudes. There is strong faculty support on the Boys and Girls club end for a garden program at the school; however faculty resources and time in the school realm is limited. Overall, participation was much greater than the first year of the project, in which no student attended 100% of club meetings.

In the future, lessening the gap between the school administration and Boys and Girls club administration may provide more effective implementation of the club. Further seasons of the program may provide necessary in order to build relationships with the students and to encourage more school support and allocation of resources.
References


**Fig 1. Example of Attitude Assessment**

**Garden Club Survey**

This survey aims to uncover students’ opinions about garden club. The purpose of this survey is to discover what encourages or discourages students from attending the club. For each of the following statements, please indicate the level to which you agree or disagree. **Using a scale of “1” to “5” where “1” means strongly agree, “3” means uncertain, and “5” means strongly disagree, please circle one number that best reflects how you feel for each item.**

SA = strongly agree, A = Agree, U = Uncertain, D = Disagree, SD = Strongly Disagree.

**Statement**

<table>
<thead>
<tr>
<th>Statement</th>
<th>SA</th>
<th>A</th>
<th>U</th>
<th>D</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I think it’s important where my food comes from</td>
<td></td>
<td></td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>2. People should know how to grow vegetables</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>3. I like gardening</td>
<td></td>
<td></td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>4. I enjoy garden club</td>
<td></td>
<td></td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>5. I would go to garden club more if more of my friends were there</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>6. I would enjoy garden club more if it were required that I attend</td>
<td></td>
<td></td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>7. I think learning about plants is cool</td>
<td></td>
<td></td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>8. My friends think garden club is fun</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>9. I like to learn about science outside</td>
<td></td>
<td></td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>10. I would enjoy garden club more if it was not while other clubs were</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>going on</td>
<td></td>
<td></td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>
Lesson plans:

I Germination
What is a seed?

- When a plant is pollinated, the information from the male plant and the female plant combine to create a plant “egg” of sorts, as a seed.
- The mother and father plants invest food resources into the seed, so when it begins growing before it has sunlight, it has food.

Seed Germination

- Germination Requires
  - Heat
    - Nature provides that seeds germinate based on environmental conditions. This way in nature, plants “know” when it is the right time to start growing.
  - Humidity/moisture
    - The plant because it is so new to the world requires a lot of moisture in its first few days because it is new to the world. Just as a baby requires a lot of attention.
  - Growing medium
    - Soil
How it works

- The plant absorbs water into itself like a balloon
- At a certain point, the seed is so full of water that it bursts
- When the seed bursts the first root and shoot are produced
II: Preparing the bed

Preparing the Bed

Components of a good soil

- Air Space
  - Required in order that roots have space to grow and to create space for water
- Organic matter –
  - Serves as slow release fertilizer as it breaks down
PLANT FOOD

- Plants “eat” sunlight, nutrients, and water
- The main nutrients necessary are Nitrogen, phosphorous, and potassium
- The soil contains these foods (nutrients) but we can add to the soil by mixing in compost
- Droppings of vegetarian animals serve as good plant food
- PLANTS LIKE COW AND CHICKEN POOP!
Nutrient Cycle

- As living materials break down, their nutrients are released into the soil by fungus and other microorganisms.
- We can use compost made from many different natural "ingredients" to provide our plants with food.

Porosity (Air Space)

- By breaking the soil into aggregates we create space for:
  - Water
  - Root growth
Garden Planning

- Plants need adequate space to grow
- Seed packets contain information on spacing
- By planning before planting we can assure better plant growth
- Space allows adequate light, nutrient, and water availability for our plants.

What can you compost?

- Paper without dyes
- Vegetarian kitchen materials
  - No animal/meat materials – can carry unfriendly garden pests
- Garden wastes that we pull from the courtyards
IV: Propagation

Propagation

- Totipotency - fancy word to explain how plants contain all the information in their tissue to grow a whole new plant
- Adventitious roots - plants have the ability to form roots at nodes, when forced
- Cloning - by taking cuttings from the mother plant we can clone the mother and make tiny copies

Propagation requires

- Moisture - to form adventitious roots
- Succulent cuttings require formation of callus
- Time. It takes time for roots to form
GREENHOUSE BUSINESS

- By saving a mother plant and making cuttings greenhouses can inexpensively make more plants to sell.
- Buy a plant for $4 dollars, after a few months you'll have a plant large enough you can make many more plants to sell.
V: Cool Season Crops

COOL SEASON CROPS
- Plants have different abilities to withstand different temperatures
- Some plants, tomatoes and peppers can’t withstand a frost
- Some plants however can
- Examples:
  - Broccoli, Kale, lettuce, brussel sprouts,
    Greens of many sorts
  - THINK GREEN PLANTS

Planting
- Seeds require spacing and moisture for success
- Just like in the germination lesson, important to keep moisture so seeds burst
- We plant more than one seed because germination rates are not always 100%
Warm season crop

- In Nebraska, we are not safe from the threat of frost until mothers day
- Frost is when temperatures are so cold, the water in some plants freezes killing the plants
- That’s why we start some plants indoors
- Warm season garden plants: Peppers, tomatoes

Misting Nozel

- It is important to mist your flats with a nozel or spray bottle in order that the soil does not splash up and expose seeds to the soil, inhibiting germination
Objectives for each lesson:

**Germination**

**Purpose:**

- To demonstrate and explain the fundamentals of plant germination
- To get across the importance of
  - Water
  - Temperature
    - On germination rates

Activities contained in the lesson:

1. Germinate been seed with paper towels
2. Quiz on information

Procedures:

- Use power point to explain the basics of germination, having students write down information in their journals which may be used on the quiz
- Participate in germination activity

Germination Activity

1. Materials needed
   a. Clear gelatin
   b. Liquid plant food
   c. Clear containers
   d. Seed for germination- bean seed
2. Methods
   a. Dilute plant food to one eight strength, in order that it is not too strong for the seeds.
   b. Use the liquid plant food as you would use water according to instructions on the gelatin packet.
   c. Pour the food gelatin in a clear plastic container, mark the containers appropriately
   d. Press the seed about one-half inch below the gelatin’s surface
   e. Place the seeds in different levels of light and temperature to see the different responses the germinating seeds have to environmental conditions
     i. Potential factors to test
        1. Amount of light
        2. Amount of heat
        3. Amount of water in gelatin

Quiz:

1. Name two things important for successful germination
2. When the seed first develops, before it can photosynthesize, how does it obtain food?
3. What does it mean to say that a seed is like a water balloon?
Preparing the garden bed

Purpose:

- To explain the cycle of energy in a garden, how plants obtain “food”
- To demonstrate the important aspects of “healthy” soil
  - Porosity
  - Nutrients
  - Organic matter
- Also take data on bean seed germination

Activities contained in the lesson

1. Check on seeds for germination – take data
2. Turn the soil, breaking up pieces into aggregates for aeration
3. Quiz on information –

Procedures:

- Use PowerPoint to explain soil structure
- Participate in turning of soil and mixing in of compost

Preparing the bed activity

Materials:

- Hand shovels and larger shovels
- Bags of compost and hay

Methods:

1. Allocate hand shovels and open compost bags
2. Show the students color of compost and contrast with color of the soil
3. Teacher uses larger soil to turn large soil chunks with kids breaking up into smaller aggregates
4. Pour bags of compost onto soil and have children mix into soil
5. Pour organic material onto soil-

Quiz:

- What are some factors important for good soil
- What does compost and organic material provide the soil
- Why do we turn the soil?
Garden planning/compost

Purpose:

- To prepare bed for installment following week
- Plan for spring plants/ tomatoes, peppers

Activities:

- Children make log/drawings, of varieties being cultivated
- Explain spacing requirements and need for space
  - Light/ water/ nutrient allocation
- Set timeline for harvests of plants
- Clear garden of last year’s material for compost bin

Procedures

1. Use power point to explain basics of composting/ planting specifics
2. Have students draw and log vegetables we will be planting

Planning/composting activity

Materials

- Materials for constructing compost bins
- Pencils/pens crayons
- Gloves

Methods

1. Lay out different seed packets of what we will be growing
2. Have students in their journals log and draw images of what we will grow and take space requirements
3. On a larger piece of poster board, design garden bed based on raised bed
4. Have children, with gloves, clear courtyards and put materials into compost bin

Quiz:

1. What are the components needed for compost?
2. What can we compost?
PLANT PROPAGATION

Purpose:

- To demonstrate the ability of plants to grow adventitious roots from their tissues
- To explain principles of “cloning” and how easy it is to increase plant biomass

Activities In the lesson

1. Explanation of totipotency
2. Take cuttings from mother plant (herbaceous – probably coleus)
3. Experiment – root in soil and root in water activity
4. Succulent cuttings – rooting, callous formation explanation
5. Quiz on information

Procedure:

- Use PowerPoint to explain totipotency, cloning, and adventitious root formation
- Explain propagation at greenhouse level
- Participate in cloning activity

Propagation Activity

Materials

1. Succulent and herbaceous mother plants
   a. Contain enough potential pieces to cut for cloning
2. Flats and potting Soil
3. Scissors or razor- to be used by instructor
4. Isopropyl alcohol for cleaning tools
5. Empty clear pop bottles to show rooting

Methods

1. Present student with mother plant and explain location of nodes (where roots can form)
2. Show students how to take a cutting and provide one for each student from the herbaceous mother plant
3. Give students cutting to place in bottles and explain how to keep water changed and filled
4. Plant some cuttings into soil meeting to see which root quicker
5. Lay succulent cuttings from mother plant on the soil to root

Quiz

1. What do plants need to form roots?
2. How are succulent and herbaceous plants different in root formation?
Planting Cool Season Crop

Purpose:

- To explain temperature requirements of plants, and show which plants qualify as cool season
- To demonstrate basics of transplanting from flats to garden

Activities:

- Planting seeds in garden bed
- Record information on germination and plant propagation

Procedure

- Use PowerPoint to discuss differences between cool season crops and warm season crops
- Make measurements with a ruler using garden plan where seeds need to go and have children plant them

Materials

- Cool season seeds
- Pencil for poking soil
- Ruler
- Sticks/labels for what we are planting
- Misting nozzle

Methods

1. Apply garden plan to bed and mark out where things need to be planted with markers
2. Instructor clears a small divet in soil to place seeds
3. Each student is given 3 seeds of a given variety
4. Students lay seeds in soil and cover with a thin layer of soil
5. Make and place label where appropriate
6. Using a mister mist the bed.

Quiz:

- What are some plants we can plant before the last frost?
- Why is it important to plant more than one seed?
STARTING FLATS OF WARM SEASON VEGETABLES

Purpose:

- To begin flats of warm season vegetables
- Discuss planting times and refer to planting tables and garden design from previous lab

Activities:

- Plant warm season vegetables into flats
- Label appropriately
- Check on cool season plants for germination as well as cuttings and germination experiment

Procedures:

- Use PowerPoint to explain Nebraska frost date and water plants can’t withhold a frost
- Explain why we are planting indoors
- Divide out seeds for planting

Materials

- Flats and seed starting substrate
- Pencil for poking holes
- Labels

Methods:

- Fill trays with soil and moisten with a garden hose with a mister nozzle
- Poke holes in each cell
- Have students put three seeds in each cell
- Label cells appropriately

Quiz

1. When can warm season crops be planted in Nebraska?
2. Why is it important to use a misting nozzle?
DATA ENTRY and EXPERIMENT CONCLUSIONS

Purpose:

- To record and make conclusions on ongoing experiments
  - Germination
  - Propagation
  - Cool season crop success

Activities:

- Students collect data on results of germination
  - Was light a factor in success of germinating plants
  - Was temperature?
- Show students adventitious roots of cuttings

Activity

Materials:

- Pens and pencils for journals
- Chart laying out successes

Methods:

- Students record data and conclusions on experiments
- Look at garden and take data

Quiz: End quiz to be determined
Table I: Individual student answers to each question
1: Strongly Agree 2: agree 3: Unknown 4: disagree 5: strongly disagree

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Table 2. : Frequency of responses for each question type. Number of 1s, 2s, 3s, 4s, 5s, received for each question from collective group

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Table III: Percent of students that agreed or strongly agreed to four categories of questions indicating why they would attend garden club

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<th>Enjoy outdoor learning</th>
<th>Social aspect influencing attendance</th>
<th>Importance of understanding food production</th>
<th>Club infrastructure influencing</th>
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<td>All students</td>
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<td>Students who never attended</td>
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