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Designing a School Garden Space that Emphasizes Children's Wants and Uses Permaculture Design Methods

Mikhaela Mullins

University of Nebraska-Lincoln

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DESIGNING A SCHOOL GARDEN SPACE THAT EMPHASIZES CHILDREN’S WANTS AND USES PERMACULTURE DESIGN METHODS

by

Mikhaela Mullins

AN UNDERGRADUATE THESIS

Presented to the Faculty of
The Environmental Studies Program at the University of Nebraska-Lincoln
In Partial Fulfillment of Requirements
For the Degree of Bachelor of Arts

Major: Environmental Studies
Major: Anthropology

Under the Supervision of
Thesis Advisor: Dr. William Waters
Thesis Reader: Dr. Daniel Osborne

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DESIGNING A SCHOOL GARDEN SPACE THAT EMPHASIZES CHILDREN’S WANTS AND USES PERMACULTURE DESIGN METHODS

Mikhaela Mullins, B.A.
University of Nebraska, 2011

Thesis Advisor: Dr. William Waters
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Abstract

A case study was organized at Saratoga Elementary school in Lincoln, Nebraska to obtain data on what children desire in a garden space. To collect this data a school garden space was constructed and an after school garden club was implemented. Students who participated in the after school garden club partook in the study by drawing their ideal garden. Elements that the subjects drew were identified and categorized into ‘highly desired’ and ‘somewhat desired’.

These elements were then incorporated into a proposed garden design plan for Saratoga. The proposal plan uses Permaculture design methods to emphasize sustainability.
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Chapter 1: Introduction

The presence of a garden in a schoolyard is not a new feature on the landscape. School gardens have been a part of school landscapes since the late 1800s, but the popularity of such a space has ebbed and flowed over the last several years. With the current environmental concerns and an understanding of how gardens benefit students the school garden is once again becoming a popular feature as a part of the schoolyard. There has been a great deal of research done that shows that children who interact with and spend time in a garden space gain life skills, have a better understanding of the natural world, and cognitively benefit from the space. When designing a school garden it is important to design the space in such a way that it encourages exploration and imagination. By developing a complex space that lends itself to being an educational tool and place of wonder, the benefits of the space are maximized. In order to have a deeper understanding of what children desire in a school garden space children ought to have a role in the design of the garden. Giving children an active role in the design process elements that they desire can be identified, emphasized, and incorporated within the structure of the garden space. By doing this the space will be a reflection of children’s desires while maximizing the benefits that can be gained.

Additionally, it is important to design a garden so that it is sustainable. One method that produces a sustainable design is Permaculture. This design method was developed in the late 1970s and has successfully been a sustainable design technique around the world since then. By using Permaculture principles
and ethics in creating a school garden the space will be sustainable and thus will be a long-term feature in the schoolyard.

Combining Permaculture design principles with the desires of children a school garden design can be made that is ecologically diverse, sustainable, and appealing to elementary students. Having a school garden that is constructed in such a way has the potential to maximize the benefits that children gain from interacting with natural spaces. Such a school garden would not deplete resources, add to the diversity of the local ecology, conserve energy, and be a lasting component in the schoolyard landscape. It is important to have studied what children desire in a garden and to have studied Permaculture so that a garden layout can be made that integrates these two aspects. Identifying key elements that children want in a garden can be done through the study of garden drawings done by students. These elements can then be coupled with Permaculture design principles to result in a final garden design for a school. Integrating these two aspects in creating a school garden will result in a site that is sustainable, appealing to children, and has the potential to maximize benefits gained from natural spaces.
Chapter 2: History of School Gardens

School gardens are not a new idea and in fact have had a significant presence in schoolyard landscapes for over 100 years in the United States. The first recorded school garden was built in the early 1890’s at the George Putnam School in Roxbury, Massachusetts (What is garden, 2010). Through the support of government, horticulture clubs, women groups and educational organizations every state had at least one school garden by 1918 (Carter, 2010).

Teachers and students knew that there were benefits from having a garden present and incorporated the space into their curriculum. In 1917 the United States School Garden Army (USSGA) was created to encourage gardening amongst children. This program was funded by the U.S. War Department to promote children to garden to help secure America’s food system by having local and sustainable food sources (Hayden-Smith, 2006). The program was highly successful and the children who participated in the USSGA program called themselves “Soldiers of Soil” and numbered over a million by Armistice Day, November 11th, in 1917 (Hayden-Smith, 2006). School gardens continued to be an important part of schools through World War I and World War II, mainly due to the popularity of Victory Gardens (Subramaniam, 2002). Victory Gardens were planted throughout the United States during World War II due to rations and shortages of food. By having a Victory Garden families were able to have a more secure food source during wartime. However, after World War II school gardens began to be replaced by playing fields for soccer and baseball and playgrounds (Subramaniam, 2002).
While the number of school gardens ebbed and flowed throughout history, today there is a resurgence of gardens being built into schoolyard landscapes. This resurgence of school garden popularity can be attributed to conferences that have been held across the country since the early 1990s (What is garden, 2010). “In 1993 the American Horticultural Society held the conference Youth Gardening Symposia that focused on how children’s gardens support educational goals and increase the aesthetic value of school grounds” (What is garden, 2010). Since this conference school gardens are once again recognized for the benefits they have for children and the local ecology.
Chapter 3: History of Saratoga Garden Project

In the spring semester of 2010 a group of University of Nebraska-Lincoln students who were enrolled in the thesis course for the Environmental Studies program formed the Garden Gang. The members of the Garden Gang had similar interest in creating school gardens and educating children about the importance of gardens. When the Garden Gang first formed there were around ten students, and over time more UNL students joined. The Garden Gang collaborated with the Lincoln Public Schools to build school gardens at Norris, Saratoga, and Randolph elementary schools in the spring of 2010 and added Park middle school in the spring of 2011. At each school Garden Gang members volunteer to be in charge of running after school garden clubs and maintaining the onsite garden space. Each school’s team leader is in charge of hosting an after school garden club, gathering materials to be used in the garden, planting, and overseeing all activities at the given garden.

Figure 1: A section of the garden at Saratoga, fall 2010.

At Saratoga Elementary school the garden space had previously been established by a teacher a few years prior. However, the teacher no longer was able to manage the site and the garden space was vacant for a year. The 17’x98’ plot already had a native grasses area established, had three benches, was
mulched, and had tomato cages on site. Using the existing materials the Garden Gang group working at Saratoga was able to begin a new garden for the school in the spring of 2010. From the donations of local businesses three 4’x12’ raised garden beds, one 6’x6’ raised herb garden bed and potato tires were built in the space (Figure 1). The raised garden beds used a no dig method, this technique is used to build garden beds with little labor, to create organic material, and are garden beds that require little maintenance (Figure 2).

Seeds were donated through the Seed Savers Exchange program Herman’s Garden. Seed Savers Exchange is a non-profit heirloom seed company based in Decorah, Iowa whose mission is to provide diverse garden seeds to people. Their program, Herman’s Garden, donates seeds to organizations that will share seeds and the harvest with the community and provides education to individuals about gardening and seed saving. With the donations of materials the garden at Saratoga could be rebuilt and planted with a variety of vegetables, fruit, and flowers.

The garden and the after school garden club has been a cooperative effort between the Garden Gang, Saratoga administration and teachers, and the after school Community Learning Center (CLC) program onsite. The CLC program is a federally funded program through Family Services that partners with Lincoln Public Schools (LPS) to provide a community connection for students and their
families. The Lena Merrill Community Learning Center at Saratoga is open before and after school for students and offers free clubs, provides further education through reading programs and the like, and is a place for students, their families, and the community to gather. Between these three groups an after school garden club was formed in the fall of 2010 that allows up to 40 Saratoga students to be involved with the garden during the school year. By participating with the garden club students were able to learn about the makeup of compost and healthy soil, photosynthesis, plant life cycles, insects and animals that can be found in a garden, and the like. Students also learned how to build a no dig garden bed and how to plant seeds, transplant, and weed a garden. To help students understand these concepts at every club meeting they were read a short story that involved some sort of gardening skill or information concerning soil, insects, sunlight, water, photosynthesis, and garden design. An hour lesson and activity were then held after the short story. Before leaving for the day the students took time to reflect on the lesson of the day by writing or drawing in their garden journal. Activities were all hands on and emphasized one gardening skill or information on what occurs in a garden. By being a part of the garden club the students were able to gain gardening skills and have hands on education in the garden space. Students were encouraged to take what they learned during club home to share with families and friends. One way they were able to do this was by taking plants and seeds home (Figure 3). The cooperative effort between the Garden Gang, Saratoga, and the CLC program has been an essential role in the success of the after school garden club. The Saratoga administration sent out sign up forms for
students to join the garden club, provided space for the club to meet in, and allowed for the creation and use of the garden space. The CLC program staff was present to offer aid and support for club leaders if need be. Without the collaboration of efforts from the Saratoga staff, the CLC program staff, and the Garden Gang the garden club would not have been possible.

The garden club students were not the only ones who utilized the garden, several teachers at Saratoga did as well. Teachers were able to use the space to complement their lesson plans in math, science, language arts and history. The native grass area of the garden can be used to aid in lessons about Nebraska’s history and flowers can be used for butterfly and insect lessons (Appendix 8). There are numerous ways that a garden can be used to accompany lesson plans and the space is easily available for teachers to utilize if they so wish to.

Figure 3: Planting wildflower seeds during garden club to be taken home
Chapter 4: Benefits of School Gardens

By constructing a garden that allows children to freely explore the garden students can increase their skills and knowledge concerning the environment. It is important to create a garden space that children can explore in by digging in the dirt, play in, use found materials (natural items, recycled items, etcetera) to play with, and have room to move in. By designing a garden space that encourages play and imagination there is opportunity for numerous benefits to be gained by children.

Gardens are an intensely localized element in the environment. Plants and animals that can be found in a garden space are a part of the natural local environment. By incorporating a garden into the schoolyard that uses organic methods, such as composting, using mulch, and not using chemicals, the local ecology will be more diverse and offer habitat for insects, birds, and other animals. When children interact with such a localized ecology they are able to interact with the natural world (Blair, 2009). By exploring and learning in natural settings students learn how to interact with nature and are able to witness the complex diversity of the environment. Research has shown that students who participate in some sort of outdoor educational activity, such as gardening, have more value and appreciation for the environment (Waliczek, & Zajicek, 1999). “Children who spend significant time in nature also show a greater commitment to protecting the natural world during their adult years (p. 68, Samborski, 2010).” By participating in activities based in a garden setting students have the potential
to increase their understanding of natural systems and have a higher value for the environment.

Gardens can be used for environmental education, but can also be used in current curriculum. Teachers can use a garden space as an educational tool by creating a space that allows for exploration, encouragement of imagination, and complex and diverse elements. Intimate spaces in the garden can be used as personal reading areas, or the outdoor classroom can be used to read fiction or nonfiction books to students. There is the possibility that gardens can be designed to reflect books as well. A garden space can be used as inspiration for creative writing as well. Elements within the garden can be identified to help younger students learn the alphabet (e.g., t is for tomato). Math and science lessons can be taught in a garden space as well. Examples of how this can be done are counting seeds, measuring water and soil used in a garden bed, charting temperatures, measuring changing sizes of plants, and so on. Arts, crafts, and music can all be done within a garden space as well. With some planning teachers can easily use a garden as an accompaniment to their lesson plans. By holding classes in a garden space or an outdoor classroom students will not only learn the given lesson, but also benefit from being outside and interacting with the natural world.

Students who are able to learn in and interact with the natural environment additionally gain skills and cognitive benefits. Using a garden as a learning space children are not only able to gain gardening skills, but gain visual-spatial, language, science, math, body awareness, social, and intrapersonal skills as well (Miller, 2007). Research has shown that after spending time in a garden or in a
natural setting students are highly motivated, have higher pride in their school, have healthier food habits, and have bonded with other students (Blair, 2009). Other life skills that are attained by participating in garden based activities are being able to work well with others, understand oneself better, leadership and responsibility, decision making, communication, and willing to volunteer to help (Robinson et al, 2005). Using a garden space to accompany lesson plans provides the setting for students to further their education and to gain life skills. By participating in activities within a natural setting, such as a garden, students will cognitively benefit as well. Attention restoration theory was developed by Stephen Kaplan that suggests that by interacting with natural settings individuals perform better on direct attention activities (Berman et al. 2008). This implies that by spending time in a natural environment individuals will be calmer and able to focus and control their attention on one set objective. Research has shown that students with behavioral or attention problems who are a part of a garden based learning program have increased engagement and awareness (Miller, 2007). If gardens are used to accompany school lesson plans and are seen as an educational tool, the space has the potential to greatly benefit students. When students spend time doing activities in a garden they will further their education, have a better understanding of the natural world, gain life skills, and cognitively benefit from the space.
Chapter 5: Introduction to Permaculture

When considering how to design a school garden space one method of design that can be used is Permaculture. Permaculture was developed in 1978 by the Australian, Bill Mollison, and one of his students, David Holmgren (Diver 2002). The word itself is a contraction of permanent culture and permanent agriculture, and is a design method used to achieve sustainable sites (Diver 2002). A current definition of Permaculture is “consciously designed landscapes which mimic the patterns and relationships found in nature, while yielding an abundance of food, fiber, and energy for provision of local needs (Holmgren 2007)”.

By following Permaculture design methods natural systems and patterns are mimicked to work in human systems, and result in a space that is sustainable.

Incorporating a garden into school landscapes benefits not only the students and community, but the space can also benefit the local ecology. By building the space to be sustainable and using organic techniques chemicals are refrained from being used, natural resources are added to instead of being depleted, and plant and animal diversity increase. As a result the garden will produce better tasting and more nourishing foods, as well as be able to be used by the school community over time.

When using Permaculture as a design method there are ethics, principles, and guidelines that are to be followed. The ultimate goal in using this design method is to create a space that is sustainable and self-efficient (Pitman 2010). To achieve this end goal there are three ethics, or moral codes, that are to be adhered to. The first ethic is care of the Earth, which includes all living and nonliving
things, such as plants, land, water, and air (Pitman 2010). Care of people promotes self-reliance and community responsibility, and is the second ethic (Pitman 2010). The third ethic is returning all surpluses to the Earth and to the people and passing on any sort of excess to our needs for the first two ethics (Pitman 2010).

While these ethics are the core of what Permaculture is, there is a set of principles that are additionally followed. The principles of Permaculture are seen more as a set of guidelines for designing a site, whereas the three ethics are the morals behind the planning process (Diver 2002). There are twelve principles of Permaculture that are to be applied during design. These twelve principles are not static and can be applied to all sites. How the twelve principles of Permaculture were used specifically at Saratoga’s garden space is discussed in chapter 8.

1. **Observe and interact**: take the time to engage with nature, by doing so design solutions that suit the particular situation can be identified.

2. **Catch and store energy**: develop systems that store excess resources that can be used at a later date.

3. **Obtain a yield**: ensure that yields are met for the work that has been done.

4. **Self-regulation and accept feedback**: discourage inappropriate activity so that systems continue to function well.

5. **Use and value renewable resources and services**: Use renewable natural resources to reduce dependence and consumption of non-renewable resources.
6. **Produce no waste**: All things can be used so that nothing goes to waste.

7. **Design from patterns to details**: Observe patterns that occur in nature and in society, these patterns are the base for designs. Once patterns are identified details of the design are filled in.

8. **Integrate instead of segregate**: Integrate elements so that relationships between things are beneficial and supportive.

9. **Use small and slow solutions**: Small and slow systems are easier to maintain and use local resources.

10. **Use and value diversity**: Higher diversity reduces vulnerability.

11. **Edge effect and value the marginal**: Edges have higher potential for diversity and productive elements.

12. **Creatively use and respond to change**: Have a positive outlook on challenges and change, observe first then react to the situation (p. 162-3, McManus 2010).

By following these principles coupled with the ethics of Permaculture the resulting design will be a functional sustainable site. Functional design is sustainable and provides high product yield, at the same time it reduces pollution and high-energy work (Pitman 2010). When designing a Permaculture site the ultimate goal is sustainability and self-efficiency. Ways to achieve this goal is to follow the ethics and design principles discussed above. Some aspects of design that are an outcome of the Permaculture ethics and principles include elements
with multiple functions, intensive planting, low energy inputs, increased energy storage, and an increase in diversity.

The Permaculture design ethics and principles can be applied to any type of site, and were used in the proposed plan for the Saratoga garden (see chapter 8). To have a clearer understanding of how to design a site using Permaculture methods, the researcher attended a two-week course through the Permaculture Institute to become certified in Permaculture design. Scott Pittman, who has worked with Bill Mollison for a number of years, taught this course. The course was held at the organic farm and ranch, Sustainable Settings near Carbondale, Colorado. During the two-week time period the group of twenty students learned the concepts of Permaculture and how these concepts can apply to a wide variety of sites. Class sessions were held from 9am to 5pm, allowed time for participating in the farm work at Sustainable Settings, and provided a hands on approach to using Permaculture (Figure 4). Working in small groups students designed a ten-acre space at Sustainable Settings using Permaculture design methods to present to the owners and staff of Sustainable Settings. Upon presenting these designs the students were then given their certificate in Permaculture design to begin practicing the skills learned during the two-week course.

Figure 4: Scott Pittman, working at Sustainable Settings and the graduating class.
Chapter 6: Materials and Methods

This study used a single-site approach by collecting data from one site and group from only Saratoga elementary school. Data relied on drawings done by elementary aged students to gain data on what children desire in a garden space. Subjects were given a worksheet with the instructions to draw their ideal garden (Appendix 1). These drawings were done by 28 students with an age range of 6-12 years old, that participated in an after school garden club at Saratoga Elementary School in Lincoln, Nebraska. Key garden elements that appeared in the drawings were identified and categorized according to repetition of the element being mentioned. Elements were placed into two groups: 1. Highly desirable by students and 2. Somewhat desired by students. Elements listed in the ‘highly desirable by students’ category were given higher preference in the design drawings. Whereas elements that were given the rating ‘somewhat desired by students’ infrequently appeared in the drawings done by the subjects.

To have the participants understand the exercise of drawing a garden design the group discussed the importance of planning a garden. Examples of various types of gardens were shown to the students and the spaces within a garden were explained to the group as well. The example gardens represented two spaces that previously existed in the garden site at Saratoga. There is a native grasses and flowers space and a raised bed vegetable garden space. The latter had two example drawings, one from a bird’s eye perspective and the second example from a straight on viewpoint. Four examples of raised garden beds were also shown to the subjects. Each sample garden varied and represented a range of plant
material. After the subjects discussed and were shown sample garden design drawings they were given twenty minutes to draw their own garden design (Figure 5). Their drawings were collected at the end of the twenty minutes to be analyzed.

Figure 5: Students drawing their ideal garden.

The results from these drawings were then analyzed to extrapolate key elements that children desire in a garden space. This was done by identifying what elements the subjects drew and how often elements appeared within the group of drawings. By identifying these key elements garden features, designs, plant materials, and activities for the space were able to be determined. The ‘highly desired’ garden elements will then be incorporated and emphasized within a proposed garden design plan for Saratoga Elementary School. The ‘somewhat desired’ garden elements will also be included in the proposed garden design, but will not be emphasized. By including these key elements and by using Permaculture design methods, the proposed garden plan at Saratoga will maximize the benefits that children gain from a garden space while being a
sustainable site. As being a part of a school club students and their families understand that photos and names could be recorded. However, to ensure the confidentiality of the subjects in regards to this study there were no photos taken of their faces, and no names were recorded.
Chapter 7: Results

There were 28 garden drawings collected from subjects that participate in an after school gardening club at Saratoga Elementary school (Appendix 4). Of the 28 drawings three were not used due to the fact that the subject did not participate in drawing their ideal garden. Data was collected from the 25 finished drawings to determine key elements that children desire in a garden space. These key elements were then incorporated into a proposed garden design plan that uses Permaculture design methods.

<table>
<thead>
<tr>
<th>Highly Desired</th>
<th>Somewhat Desired</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Feature</td>
<td>Insects</td>
</tr>
<tr>
<td>Grasses</td>
<td>Animals</td>
</tr>
<tr>
<td>Flowers</td>
<td>Trees</td>
</tr>
<tr>
<td>Fruit Trees/Bushes</td>
<td>Human Activities</td>
</tr>
<tr>
<td>Vegetables</td>
<td>Seeds</td>
</tr>
<tr>
<td>Sun</td>
<td>Bush</td>
</tr>
<tr>
<td>Garden Bed</td>
<td>Unidentifiable Plant</td>
</tr>
</tbody>
</table>

Table 1: Elements in garden design drawings

There were 14 elements identified within the 25 drawings (Table 1), of the 14 elements there were seven that stood out and were the most common elements drawn. The seven elements that occurred the most often in the garden drawings will have a greater emphasis in the proposed plan. This means that these elements will be highlighted and occur multiple times throughout the design. The
remaining seven elements will also appear in the design, however they will be secondary.
Chapter 8: Proposed Garden Design for Saratoga

Children’s wants were incorporated by using Permaculture design methods to maximize the benefits that the space provides for children. The highly desired elements that were identified from the garden drawings done by the subjects can be found throughout the proposed plan for Saratoga’s garden (Figure 5). To incorporate the elements that children desire in a garden space the design followed Permaculture methods. As listed in chapter 5, there are twelve principles of Permaculture that can be applied at all sites. How the twelve principles of Permaculture were implemented at Saratoga is described in detail here.

1. **Observe and interact:** The garden was observed for a year to better understand natural occurrences within the space. Such as, where shade is, how water drains, wind, and so on.

2. **Catch and store energy:** Incorporate ways to catch and store energy, such as the use of mulch, compost, and raised garden beds.

3. **Obtain a yield:** Planting space was maximized by creating key-hole garden beds, using trellis’s, and an herb spiral, while still keeping its integrity in being an educational space.

4. **Self-regulation and accept feedback:** Set rules for the garden that emphasize to students to respect the soil, plants, and animals so that things can grow and live within the garden.

5. **Use and value renewable resources and services:** Use recycled materials when creating objects within the garden. Additionally
organic gardening techniques are used and use a compost system onsite.

6. **Produce no waste:** Consume all produce and compost materials.

7. **Design patterns to details:** Designed the site with natural systems in mind, such as wind direction, shade, and so on. By being mindful of these factors the details of where elements are located within the design were filled in.

8. **Integrate instead of segregate:** Companion planting is encouraged to be used within this design allowing for beneficial and supportive relationships between elements. Elements that children desire in a garden space were integrated into the overall design of the space.

9. **Use small and slow solutions:** Having small but intensive spaces within the site, such as a herb spiral, tend to be easier to maintain.

10. **Use and value diversity:** Various planting spaces are located within the design to encourage a variety of plant life.

11. **Edge effect and value the marginal:** The edges of spaces, such as Zone Five: Native grasses and flowers, create a diverse space within the garden.

12. **Creatively use and respond to change:** Always be observing the space to see how things interact so that necessary changes can be made.

Another aspect that is to be used when designing a site using Permaculture methods is the use of sectors or zones. Zones are areas that are identified within a
site as having differing requirements of labor. For example, areas that are listed as zone I are the most labor intensive and are spaces that ought to be visited or worked on every day. On the other hand areas that are listed as zone V require little to no maintenance and rarely are visited. Within the garden space at Saratoga there are five zones that have been identified. Zones are an important aspect to consider in a design so that the priority and maintenance of elements is known.

**Zone I:** Key-hole garden beds and herb spiral: very intensive spaces, need to be visited almost daily.

**Zone II:** Strawberries, pea tepees, squash mounds and three sisters mounds: not as intensive as zone one but require weekly maintenance.

**Zone III:** Compost and sitting space: easy access spaces that do not require intensive maintenance.

**Zone IV:** Sunflowers: Space that requires little maintenance.

**Zone V:** Native grasses and flowers: uncultivated space, a ‘wild’ space within the site.

Figure 5: Proposed plan for Saratoga Elementary School
By using zones within a design energy can be focused into specific areas to benefit the system. The placement of plants and structures reflect the use of zones as well.

The elements that children desire to have in a garden space, such as water, grasses, flowers, fruit, vegetables, and the sun can all be found within the space. There is a native grasses and flowers space that provides habitat for animals and attracts birds by placing bird feeders, birdhouses, and a birdbath within the zone. Fruit and vegetables can be planted in zones one and two and can easily be accessed by students. The sun can be emphasized through the understanding of photosynthesis, but also through the use of materials that attract the sun, such as a sun catcher. Other elements that children desire, such as insects, animals, trees, bushes, human activities, and miscellaneous plants, can all be found in the design as well. Insects and animals can be found throughout the space by providing habitat. Bushes can be found in zone five as flower bushes. There is not a tree located within the garden, but there are trees surrounding the space that provide shade for the sitting area. The implementation of seeds and human activities can be emphasized through lesson plans.
Chapter 9: Conclusion

Having an understanding of what children desire in a school garden is a key step in the design process. Incorporating elements that children want will make a garden more appealing and provide children with a connection to the site. Another important design method that should be considered when designing a school garden is Permaculture. Using Permaculture principles and ethics will result in a complex and sustainable site. Designing a school garden that includes children’s wants with Permaculture principles and ethics will produce a site that is diverse, sustainable, appealing to children, and maximizes benefits gained from interacting with natural spaces.

For this project drawings were collected from children at Saratoga Elementary School in Lincoln, Nebraska who participate in an after school garden club. There are currently 28 students from Saratoga that are a part of the garden club. The students this spring were able to be a part of preparing the current garden at their school as well as influence the future design for the garden. To be able to incorporate what children want in a garden their drawings were studied to identify key elements. Once key garden elements were identified those ranked as being ‘highly desired’ were emphasized within the design. Those elements that were not identified as ‘highly desired’ were also used within the design, though not as greatly stressed. Permaculture principles and design methods were also used in designing the proposed garden for Saratoga. Combining Permaculture principles with the wants of children a proposed garden design was constructed for the site at Saratoga. By integrating what children desire with Permaculture
design methods the proposed garden site is sustainable, complex, and educational
as well as beneficial for the students and community.
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## Appendix 1: Results from Garden Drawings

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**CODES**

- **E1**: Water feature (waterfall or pond)
- **E2**: Grasses
- **E3**: Flowers
- **E4**: Insects
- **E5**: Animal
- **E6**: Trees
- **E7**: Fruit Tree
- **E8**: Bush
- **E9**: Vegetable
- **E10**: Garden Bed
- **E11**: Human Activity
- **E12**: Seeds
- **E14**: Sun
- **E16**: Unidentifiable Plant
Appendix 2.1: Garden Examples
Native grasses and flowers
Appendix 3: Select Student’s Garden Drawings

Boy, first grade.
Girl, third grade.
Girl, fourth grade.
**Appendix 5: Proposed Garden Plan**

**Zone I:** Key-hole garden beds and herb spiral: very intensive spaces, need to be visited almost daily.

**Zone II:** Strawberries, pea tepees, squash mounds and three sisters mounds: not as intensive as zone one but require weekly maintenance.

**Zone III:** Compost and sitting space: easy access spaces that do not require intensive maintenance.

**Zone IV:** Sunflowers: Space that requires little maintenance.

**Zone V:** Native grasses and flowers: uncultivated space, a ‘wild’ space within the site.
Appendix 6: Recommendations for Future

These are some things to consider for the future at the Saratoga garden site.

- Accommodating students in wheel chairs so that they can be a part of garden activities.
- Accommodating students who are blind so that they can be a part of garden activities.
- Have the produce from the garden go into the Backpack Program at Saratoga so that students are able to have more fresh vegetables and fruit.
- Make the space wider so that more raised beds can be built.
- Have a rain barrel onsite for water collection.
- Use worm composting.
- Have a tool shed onsite for storage of tools and extra materials.
- New benches or sitting tree stumps for the classroom or creation station area.
- Items to accent the garden, such as wind chimes, sun catchers, and small windmills.
- Acquire gloves and watering cans for students.
- How to involve the school community in the garden.
- How to have teachers be more involved in using the garden space to accompany lesson plans.
Appendix 7: Resources

1. **Starting a school garden**

   There are several books and online sources that discuss starting a school garden program, these are just a select few that are available.

   - *Developing a Sustainable Garden Program: Lessons Learned from Growing Minds*
     - Chapters include: planning and designing a garden, how to implement a program, fundraising, involving volunteers, curriculum and how to include the garden, and resources.

   - *School Garden Wizard*
     - [http://schoolgardenwizard.org/](http://schoolgardenwizard.org/)
     - Discusses gardening and plant based learning by using a garden. Includes how to start a garden based learning program, how to create the garden, curriculum, and downloads.

   - *School Garden Weekly*
     - [http://schoolgardenweekly.com/](http://schoolgardenweekly.com/)
     - A blog that has videos and text for instructional school garden activities.

   - *Gardens for Learning – Creating and Sustaining Your School Garden*
- A guidebook that discusses school gardening, planning for a school garden space, linking gardens to curriculum, promoting healthy lifestyles, designing the garden, finding supplies and funding, planting, maintaining and sustaining the garden, and working with volunteers.

- **Setting Up and Running a School Garden: A Manual for Teachers, Parents, and Communities** published by the Food and Agriculture Organization of the United Nations, 2005
  - [http://www.fao.org/docrep/009/a0218e/a0218e00.htm](http://www.fao.org/docrep/009/a0218e/a0218e00.htm)
  - A guidebook available in print or online that discusses starting a school garden. Looks at what a school garden involves, involving families and community, aims and principles for the garden, raising awareness, what a garden needs, nutrition, marketing, organizing work, maintaining and sustaining the program, and so on. Also includes fact sheets for various fruits and vegetables.

- **Kids Gardening**
  - [http://www.kidsgardening.org/](http://www.kidsgardening.org/)
  - A website through the National Gardening Association that specializes in children gardening. Includes garden activity ideas, resources, and contacts for other school garden programs.
2. **Tools and materials used in the Saratoga garden space:**

- Shovel for moving soil and turning compost pile
- Trowel for transplanting plants and planting seeds
- Rake for moving mulch and turning compost pile
- Screwdriver for building raised garden beds
- Screws for building raised garden beds
- Lumber for raised garden beds
- Tires for potatoes
- Tomato cages
- Hose
- Twine to mark off feet in the raised garden bed
- Poles for trellis
- Chicken wire for trellis
- Bicycle rims for trellis
- Tree cookies for walking path
- Compost for raised garden beds
- Topsoil for raised garden bed
- Straw for raised garden bed
- Newspaper for raised garden bed
- Cardboard for raised garden bed
3. **Resources for seeds:**

- Seed Savers Exchange: Herman’s Garden Seed Donation Program
  - [http://www.seedsavers.org/hermansgardenletter.htm](http://www.seedsavers.org/hermansgardenletter.htm)
  - Program through Seed Savers Exchange that donates heirloom seeds to groups that will educate and pass on seeds to the community.

- Heirloom Seeds

- Baker Creek Heirloom Seeds
  - [http://rareseeds.com/](http://rareseeds.com/)

- Victory Seeds

- Seeds of Change
4. **Resources for sustainable gardening:**

  - Includes a how-to section for sustainable gardening, materials and tools needed, and a section on plants.

- *The Sustainable Vegetable Garden: A Backyard Guide to Healthy Soil and Higher Yields* John Jeavons and Carol Cox
  - Easy to read how-to book for beginner gardeners. Shows how to cultivate common vegetables using organic methods. Discusses intensive gardening methods, preparing garden beds, composting, starting seeds, and maintaining a garden.

- *Introduction to Permaculture* Bill Mollison
  - An in-depth exploration of what Permaculture is and how it can be applied in large and small scale settings. Covers the principles of Permaculture and design methods.

  - Introduces Permaculture and how its principles and design methods can be applied at home in rural and urban settings. Goes into depth about soil fertility and structure, catching and conserving water, providing habitat for insects, birds, and animals, and how to grow food.

- *Starter Vegetable Gardens: 24 No-Fail Plans for Small Organic Gardens* Barbara Pleasant
o Includes 24 illustrated small-scale organic garden designs.

Discusses organic gardening techniques, year-by-year overviews of the 24 designs, and recommendations for producing higher yields.

• The Old Farmer’s Almanac
  
o http://www.almanac.com/

o Great source for finding last and first frost dates by zip code, tips for gardening, includes a planting calendar and recipes for produce.
5. **Sample Garden Activities**

Examples of activities that can be done in a school garden.

- Planting wildflower seeds in paper egg cartons that can be taken home and transplanted.
- Making garden journals to record thoughts about the garden and drawings of plants, insects, and animals in the garden.
- Explore the soil for worms and other insects to see what all lives in a garden space.
- Designing a garden for ideas of what to incorporate into the garden space.
- Three-sisters planting to talk about Native American planting methods and stories.
- Building a compost pile to understand how soil is made and how garden scraps can be reused.
- Making sun catchers and wind chimes.
6. **Community Resources**

- **Prairieland Dairy**
  - [http://www.prairielanddairy.com/](http://www.prairielanddairy.com/)
  - Sells compost (possibility of donations)

- **Ecostores Nebraska**
  - [http://www.ecostoresne.org/](http://www.ecostoresne.org/)
  - Reusable low-cost building materials

- **Nebraska Master Gardeners**
  - [http://extensionhorticulture.unl.edu/mg/](http://extensionhorticulture.unl.edu/mg/)
  - Volunteers can help with simple gardening skills for the students

- **Nebraska Bioneers**
  - [http://www.nebraskabioneers.org/](http://www.nebraskabioneers.org/)
  - Group of individual’s seeking to inspire communities for environmental change, is source for Permaculture knowledge.