Sustainable Generations:

A proposed Relationship Between Local Youths and Sustainable Agriculture

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**Abstract**

Addressing issues of sustainability through informative methods, our group decided to propose the idea of using community education classes to engage children in learning about these issues through hands on educational experiences. In our paper, we discuss how the four legs of sustainability play a role in our project, along with the benefits the community education classes would provide. Through examining literary references, similar organizations, and other forms of research, we concluded that hands on community education classes would prove to be beneficial to the community, the children, and the environment.

Sustainable Generations

A Proposed Relationship Between Local Youths and Sustainable Agriculture

Throughout the years, education about environmental issues has proven to be a growing field, with many elementary and middle schools now supplementing their curriculums with environmental science classes and similar courses. Teaching the younger generation about these issues, while focusing on solutions and problem solving is a feat our project aims to accomplish. We plan to address several problems with our food systems by teaching our future generations about sustainable gardening. We feel that if more children were made aware of the benefits of sustainable gardening, community gardening, and domestic gardening that the future of corporate and monoculture farming and other unsustainable farming practices will be addressed. Starting with younger children can help implement skills and a mindset that they will then carry on throughout the rest of adolescence and adulthood. Elementary aged children often easily pick up on concepts, making their age group a target demographic. Aiming to make projects fun will help keep them interested in the field of environmental science, specifically sustainable agriculture. Our plan to carry out this idea includes two separate community education classes, one targeted towards younger elementary children, and the other for fifth grade and up. The first workshop will include basic garden education and provide a fun environment for young children to learn about sustainable gardening. The second will be for older children and will teach them how to implement the use of their own global bucket at home. Our plan will view this idea from all perspectives of the four legged chair, including the costs of the projects, the social and environmental benefits, studies on similar projects, and how the area of Allendale and Grand Valley State University would be ideal for this idea.

**Literature Review**

Our project aims to solve environmental issues by educating the youth in the area, in hopes that they will then carry on an interest into their teenaged and adult years. Cross-culturally, studies have found that aiming environmental education towards younger children has a positive impact, as they tend to pick up on concepts easily and quicker than adults would. In Australia, a team researched the effect of environmental education on a group of children ages 4 to 5. The purpose of the experiment was to take children into a hands on environment, attempting to make learning interesting and relevant to their own lives (Davis, 2009). The project focused on the endangered Australian Greater Bilby species. The team wanted to know if the “forest adventure” would change the children's knowledge and behaviors towards the issue. The children were first introduced to the issue through orientation, then participated in a half-day of fieldwork, which involved going into the forest to conduct hands on experience with simple tools and exploration. The prep students were then taught further about the issue of animal endangerment, and assigned outside class work and projects. The forest project also included a Greater Bilby character, who provided narrative and taught the children in a fun, hands on way. To examine the results, the children were then split into separate focus groups and placed with teachers and parents who had prior knowledge and relationships with the students. The focus groups were held in increments of 30 minutes each. To benefit the adults, the researchers also held focus groups with the parents to discuss environmental issues and increase their knowledge about Greater Bilby endangerment. Results found that the children held increased intelligence about animals after the experiment. For example, two children aged 4 and 5 were able to tell the difference between a rabbit and a bilby because of their morphological differences. They were able to tell them apart because of their nose sizes, even though the two animals have other features that were common. The two children were also able to communicate how they know this, by pointing out the size in length (Davis, 2009). The children were also better able to identify native Australian species, contributing a beneficial cultural identity. The project as a whole produced entirely positive results, although I believe it would have been beneficial, and perhaps more complete, if they had conducted preliminary testing on the students before taking them into the hands on experience. Putting them into test groups beforehand to examine their knowledge and communication of animals would have shown whether or not their skills had really changed, and how much. The change in positive attitudes however, I think is one of the most notable effects, showing that a fun experience will drive children to be more willing and open to learn.

Another study, done in the United States, also held similar results. Eighteen preschool children in Pennsylvania took part in a learning experiment to see if they could pick up on environmental concepts quickly and with ease (Witt & Kimble, 2007). Although the lessons were not as interactive as in the Australian one, they still attempted to engage with the children to make it seem fun and interesting. This included a lot of direct observation, such as watching how seeds grow, or looking at the differences between caterpillars and butterflies (Witt & Kimble, 2007) Unlike the previous study as well, the researchers did conduct a preliminary test with the students to score their prior understandings of environmental issues such as littering, plant growth and recycling. The test that was given after the lessons indicated that every child's knowledge of these subjects improved after the activities. Particularly, their knowledge of littering and recycling issues dramatically improved.

Along with an increased knowledge of environmental issues and an increased willingness to learn in the outdoor setting, there are other benefits found for children that participate in horticulture programs found in school systems, hospitals, botanic gardens, and after school recreation sites. These benefits include; development of social skills and interpersonal relationships, increasing self-esteem and self-confidence, enhancement of the child’s sense of control, and the development of prevocational skills such as following directions, staying on task, and accepting feedback (Simson, 2003). It has been hypothesized by Dorothy Matthews and Susan M. Jenks (2010) that contact and exposure to dirt, specifically Mycobacterium that can be found in the earth’s soil, may decrease and alleviate levels of anxiety in children and adults. They tested the impact of mycobacterium vaccae on mice and found that those exposed to this microbe could complete a maze faster and show less anxiety than the mice who had not been exposed. The researchers suggested that if contact with the microbe affects mice it is likely that it affects people. In her oral presentation of their findings, Jenks stated, “From our study we can say that it is definitely good to be outdoors- it’s good to have contact with these organisms. It is interesting to speculate that creating learning environments in schools that include time in the outdoors where M. Vaccae is present may decrease anxiety and improve the ability to learn new tasks.”

The therapeutic benefits of gardening and community gardening in specific have also been studied. The most researched benefit of gardening has been increased health as a result of exercise and physical labors in the garden (Michaels M. 2014). Those who engage in physical activities like gardening have been found to have an increased sense of well-being. When it comes to community gardening, getting together in the garden setting and engaging with other students or members of a community can enhance social interactions and in turn also increase an individual's sense of wellbeing (Michaels M. 2014). Simson and Straus (2003), also note that learning to care for another life form and raising a successful plant can also increase a child’s self-esteem. Community greening organizations are making a greater effort to tap the positive energies of youth and to cultivate in them a sense of community stewardship. Engaging students in outdoor activities such as sustainable gardening, may not only promote the health of the environment and the physical health of the child but also the child’s mental health and success in life.

There are also biological benefits to implementing the idea of giving each child a bucket to grow a tomato plant in. The buckets create a sort of closed system that uses atmospheric pressure to keep the perfect amount of water in the soil and sealing off the top of the bucket means that no outside organisms like weeds will get into the soil. The lack of weeds is an immediate positive for anyone who has ever done any sort of weeding before, but the benefits of having the perfect amount of water in the soil are much more hidden to the common mind.

As it turns out, plants are very sensitive to the amount of water in the soil, they can die of drought as well as drown if the water levels get too extreme. The fact that this closed bucket system uses atmospheric pressure to regulate the amount of water means that there will always be enough water in the soil, if the plant is rapidly growing and consuming more water from the soil it will be instantly replaced. And if the plant is not growing and isn’t consuming water the atmospheric pressure will not push more water into the soil.

This closed system also eliminates potential erosion of the soil during high amounts of rainfall, since all of the soil will be contained inside of a closed bucket. In *Principles of Soil Conservation and Management*, Rattan and Humberto explain that, “soils with high clay content have high shrink and swell potential and can respond rapidly to changes in precipitation. Excessive rain can also make soils too wet for cultural operations. Soils that are too wet are structurally unstable and susceptible to compaction by traffic” (526). This is also especially important when dealing with an area such as the Sustainable Agriculture Project (SAP) here on Grand Valley’s campus because of the very high clay content in the soil. Even a small rainstorm here can lead to massive flooding at the SAP, leaving standing water in the areas with lower elevation. If standing water is left on the ground for too long the plants can literally drown to death. This is because their roots will no longer be able to take in oxygen from the small air spaces normally found in soil.

The microbes present in the soil also play a large role in the development of plants and also contribute to the amount of chemical runoff found on larger scale farms. In a study performed by Bender and Heijden, it was proven that increasing the amount of microbes and arbuscular mycorrhizal fungi in soil leads to an increase in plant production and a reduction in leaching of nutrients.

Specifically, this study involved two man made soil sites, one with enriched soil life and one with reduced soil life. The seed coats were sterilized prior to planting to ensure no unwanted bacteria made their way into the soil and equal amounts were planted into each plot. In the first year of the study, leaching of Nitrogen out of the soil was over 50% lower in the enriched soil life plot compared to the reduced soil life one and the leaching of Phosphorus was also significantly lower in enriched soil life (232).

Plant biomass in the enriched soil life plot was 22.3% higher after one year than the biomass found in the reduced soil life plot, indicating that the microbes and mycorrhizal fungi within the soil significantly contribute to the development of plants. “Four months after the start of the experiment, roots of the RED [reduced soil life] treatment already showed 10-25% root colonization by AMF [arbuscular mycorrhizal fungi], while the ENR [enriched soil life] treatment showed 75% root colonization” (Bender & Heijden 233). It’s clear that the amount of fungi present in the plots differed greatly and there were large benefits to soil enriched with fungi and microbes.

Although the global buckets (a closed system) that will be implemented offer some differences when discussing the effects of leaching and erosion, the core aspects remain the same. Through the use of these global buckets, children will be taught why the proper amount of water in the soil is important for growth and how microbes in the soil reduce the amount of chemical runoff. This will help the children greater understand the complex nature of growing crops in soil.

**Review of Community Organizations**

The goal of community education is to enhance the chances of a student's success outside of the classroom setting. We plan to not only enhance the success of the individual but also the success of the environment. With our proposal we hope to engage students of Allendale public schools and other surrounding school districts through the Allendale community education program with Sustainable farming and gardening activities. We plan to create a partnership between the community ed program and Grand Valley’s sustainable agriculture project. Our idea includes two workshops for different age groups to be held at the SAP doing a variety of activities. Other organizations have taken on a similar goal. In Grand Rapids the Steil Boys and Girls club has partnered up with Amway Global and their positive sprouts project. The project aims to give local kids hands-on gardening experience with special classes about gardening and nutrition. The boys and girls work on a community garden located at 235 Straight Ave. NW. The plot features different themed gardening beds, where the children grow vegetables for different food dishes such as pizza, salads, and salsa. They also have a large squash plot and a butterfly garden (Shawgo, 2010). Another local organization that works to engage children with nature and gardening is Fredrick Meijer Gardens. While no hands on sustainable gardening classes are offered, they do offer many workshops for children and their families throughout the summer. We wish to replicate and expand on some of these preexisting ideas.

**Materials and Methods**

Our plan is to form a partnership between Grand Valley State University’s Sustainable Agriculture Project and Allendale Public Schools’ community education program. It is our goal to implement two community education workshops at the SAP. With this partnership Allendale’s community ed program would advertise the workshops and they will be held at Grand Valley’s SAP in June as a fun summer activity for the kids of Allendale and surrounding areas. The thirty dollar costs of the classes would go towards supplies for the workshop and to pay the partnering organizations. We have configured that cost of materials for each participant in both workshops would be less than ten dollars. That leaves the remaining amount to be split between Allendale community organizations and the sustainable agriculture project and back to the community.

The first workshop would be tailored for elementary aged students. We planned to have this workshop take place over three different days, with different themes, each 1 to 2 hours long. The first theme would be “The Lifecycle of a Seed : How Plants Grow”. On this day students would learn about the plant and get the chance to plant their own tomato plant to take home and mend to. For the second class we propose the theme of “Butterflies and Bees”. This would be a good opportunity of teaching the importance of pollination on agriculture. The SAP has a bee hotel on site and as an activity students would build their own bee hotels out of pop bottles, reeds, sticks, acorns, and other objects found in nature (see figure 1). The third theme will be “Harvesting Seeds”. Students will get a tour of the SAP gardens to learn when edible plants are ready for harvest. This day will include a skit or a song and garden games. These theme have been chosen based on previous studies that were mentioned in our literature review. We figured that these workshops would also act as an opportunity for GVSU education majors to get out to the SAP and teach a lessons as a part of their major requirements. For these workshops we would need materials for planting a tomato plant and building a bee hotel. These materials include planting pots, tomato seeds, 2 liter pop bottles, twine or rope, straws or pipe cleaners, bamboo poles or reeds, sticks, acorns, pinecones and other objects found in nature.

For the second workshop, tailored for those in 5th grade or above, we chose to use sub-irrigated “global buckets” combined with a “living organic soil.” We chose this method for a number of reasons. To start, these buckets can be produced cheaply, and in some cases, it is even possible to get a number of the components for free. This is done by recycling or diverging waste that could potentially be useful for production of global buckets. Another reason this is a desirable solution is due to the ease of use. With a properly amended soil, and a global bucket, gardening is a breeze. For this reason, when maintaining global buckets, all of the guesswork is taken out of watering. It is literally impossible to over or underwater as long as the reservoir of the global bucket is full.

Another reason these global buckets were chosen, is because they conserve a significant amount of water over conventional potted plants, and even raised beds. The reason behind this, is that the global buckets function based off of capillary action. The water that undergoes this process is drawn from a sub-irrigated reservoir, which is completely contained between the soil and another bucket. Furthermore, black plastic mulch is used on top of global buckets to eliminate loss of capillary water to evaporation. Often in potted plants, Water within the pot is lost due to higher above ground temperatures and improper mulching. This is not so with global buckets, which use capillary action and plastic mulch to conserve as much water as possible.

Conservation of water is an issue that will continue to be present throughout upcoming generations. It is already clear that some regions of the world, and even the United States, need to come up with measures to conserve water and use it as efficiently as possible, so as to not exhaust it as a resource. Global buckets are all about conservation of resources. In fact, many of these supplies are easily sourced for free at local restaurants, which typically receive pickles in 5 gallon buckets.

Another important component of the global bucket is an organic soil. This can be readily made with local native soil, or with some purchased components. However, unless one has a fair knowledge of soil compositions it would be recommended to make soil from an even mixture of peat moss, aeration, and compost. This creates a base soil with good drainage and organic matter content. Additionally, adding amendments such as alfalfa, kelp, manure, etc. can further improve the nutrient content. In taking these extra steps, soil becomes far more fertile. As a benefit, most can also be locally sourced for little cost, and in some cases no cost.

If one were to make Global Buckets by simply purchasing materials, they ultimately cost less than $10 per bucket setup. Each 5 gallon bucket at home depot costs about 3 dollars. Each bucket setup requires just 2 buckets, a solo cup, and a 24” section of PVC pipe. With 2 hole saws and a drill bit, construction of global buckets is quick and easy. Furthermore, solo cups and 1” diameter PVC pipe can be bought in bulk further reducing the costs (see figure 2).

Obviously sourcing second hand materials or diverting waste from landfills is desirable. This is another concept that is ideal to teach kids in workshops. Not only is sustainable agriculture about using more ecologically sound methods, it is also about reducing consumption. This can be done by reusing materials that may otherwise end up in a landfill. My local deli is happy to supply me with their old pickle buckets, which I use for various projects. They are happy to see them used as opposed to sitting in a landfill. This concept should be passed along to promote sustainable thought processes of students, and to make them conscious of the costs of our choices, as well as the possible ways to minimize them.

Finally, one of the most impressive benefits of using sub-irrigated planters, or global buckets, is the condition in which they keep the soil. While they do not remediate soil, they keep it at the perfect level of saturation for beneficial microbes and fungus to thrive. With an organic soil, all of the important nutrients are “amended” into the soil, and mixed in before planting. Essentially, what happens here is the beneficial microbes and fungi already present in the soil begin feeding on the amendments. These amendments are full of micro and macro nutrients. When they are consumed by detritivores, they become either immobilized or mineralized within the soil. Because of this, it is nearly impossible to lose nutrients to leaching, as is the case in traditional monocultural fertilizers. When it rains, typically nutrients are brought immediately to the bedrock. Not so with organically amended soil. For this reason, it is far more efficient, as well environmentally sound to use amended soils and encourage microbial life. This is as opposed to conventional techniques, which use chemical fertilizers that pollute the groundwater when they leach into the soil from heavy rains.

**Conclusion**

Our proposal aims to educate elementary aged children in environmental issues, while making the projects fun and hands on. Combining our majors and special interests, we developed an interdisciplinary plan looking at the issue of sustainability and education from different perspectives. We also addressed the four legs of sustainability by examining the social and psychological impacts community education classes and gardening has on children, the economic factors that play into developing such a class, how it would benefit the environment, and how Grand Rapids and Allendale would be an ideal community spot to hold said classes.

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Figure 1

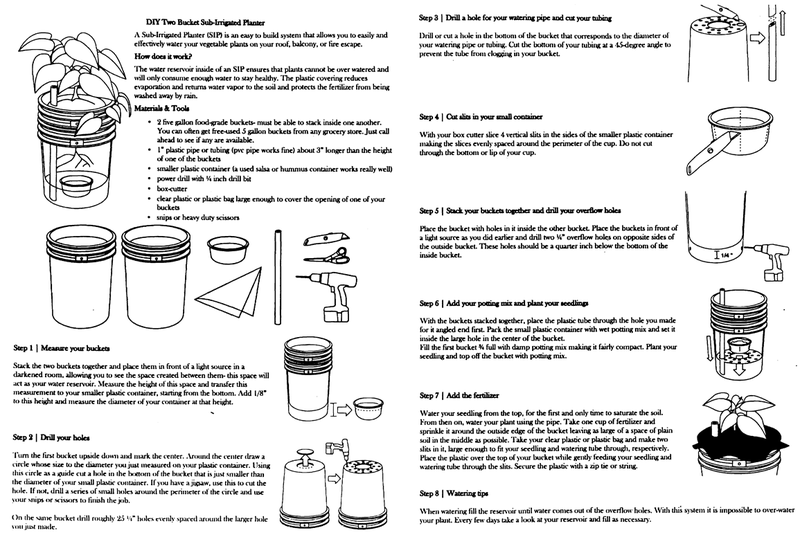


Figure 2