Sustainability: Making an Automated Garden

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Introduction

In every Biology course, students are introduced to many different biological processes. The main commonality in all biological processes is that they are self-sustaining. Sustainability as it relates to environmental resources is important because our choices of today affect our quality of life in the future. So, how does creating a self sustaining automated garden help 10-12th Grade boys to value and understand the importance of sustainability? Through the act of creation, Making is about turning awareness into action and learning through the construction of real life models. The concept of the Maker Movement encourages problem solving and learning in a creative environment where innovations and ideas can be fostered and advanced. When a young man creates or makes something his interest and engagement always seems to be greater. According to one champion of the Maker Movement and founder of *Maker Magazine*, Dale Dougherty, the biggest opportunity (and challenge) for the Movement is in transforming education. His hope is that the agents of change in the Movement will be the students themselves.

Research Question

How can making an automated school garden help 10-12th grade boys value sustainability?

Research Context

Saint Augustine High School is a Catholic, college preparatory high school for young men grades 9-12. Saints, as it is known, has an enrolment of approximately 700 young men from the greater San Diego, CA and Tijuana, Baja California region with a rich ethnic and racial mix.

Participants

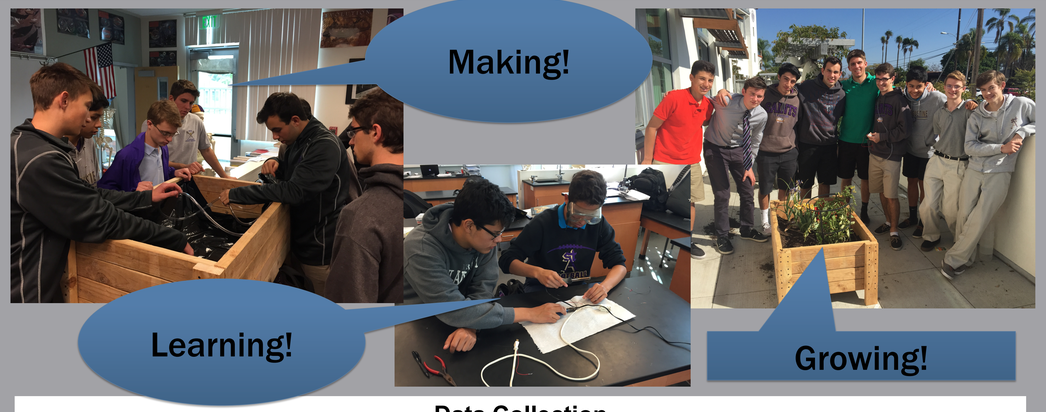
Participants were 30 Advance Placement Biology students. Their Grades ranged from 10-12th. Students were divided into three teams of 10 students.

Research Action

This project was to create an automated garden that has one or more components considered sustainable or self-sustaining.

I decided to give only a few guidelines to help foster creativity and allow them to have ownership of their project.

Each team had a budget of $100 to be spent on technologies they may need. All other equipment was repurposed material.	The teacher provided the dirt used in the garden and the only soil enrichment for the gardens came from the compost that is being currently made by the school's recycle program .	The garden had to maintain a minimum of three plants.

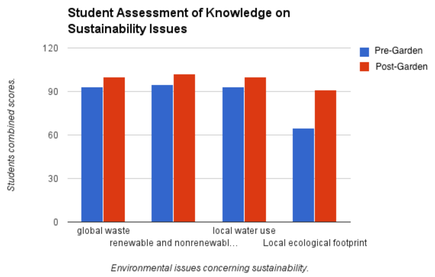


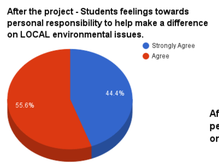
Data Collection

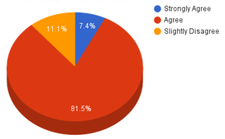
Data collection efforts included both qualitative and quantitative methods, including: student-completed pre-post questionnaires on their value and previous knowledge of sustainability, interviews with student groups, journaling on their learning process and filming/direct observation of the design and build of the garden.

Data Analysis

Student questionnaires were analyzed by comparing mean score differences. The results from the questionnaires showed that after making the garden, students felt that their knowledge base regarding sustainability and environmental issue increased. Student responses also showed an increase in their perception of the value of sustainability locally and globally







Key Findings and Discussion

Throughout the process of observing and interviewing the students, a few themes became apparent almost immediately. To paraphrase one student: The Maker project of building an automated sustainable garden was challenging and fun. It was beneficial for us in understanding how sustainability plays a role in local and global environmental issues.

- Students were making a strong effort to have their sustainable automated garden truly sustainable. I observed several times during the design phase students asking each other, "How is that sustainable?"
- Students found it challenging to complete their project with little direction. Not having a clear step by step process to build their projects was initially difficult for them. I was asked many times "Can we do this?"
- Students were afraid to fail. One of the teams that started off designing a self watering system and changed their design and plans midway through the project. Their project was a good design but fear of failure played a strong role in their change in design plan.

Conclusions

There are many positives that have came from this project. The Maker mindset or culture is one of openness and collaboration. This mindset became contagious within my class.

Sharing Ideas

The students took ownership of their learning. They researched, designed and built something that became important to them.

Ownership

Students are more engaged and want to learn more to make their ideas work. This type of project touched on both student creativity and critical thinking skills.

The final and most impactful positive effect that I observed during this project was an increase in the confidence and curiosity of my students. Making something that was important to them was truly fun for them and for me.

Key Readings

Martinez, S. L., & Stager, G. (2013). *Invent to learn: making, tinkering, and engineering in the classroom.* Torrance, Calif.: Constructing Modern Knowledge Press.

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McNiff, J. (2010). *Action research for professional development: Concise advice for new action researchers (New rev. ed.)*. Poole: September Books.

Iseman, L. (2013, October 16). *The Garduino Garden Controller*. Make, 90-91

Orzali, J (2009) *Connecting Students to Sustainability through Hands-on Learning in the High School Science Classroom*. Harvard University

Further Information

This poster and further information is available at http://www.theibsc.org/.
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