

2018 Faculty Innovation Grant Proposal

Middle School Tower Garden Systems

Name: Megan Dolan

Subjects Taught: Library

Total Years Teaching Experience: 15

Degrees Held: BA in Spanish, Masters in Library Science

Signature of applicant

Name: Bethany Shannon

Subjects Taught: Science 7, Physics, Realizing Architecture through Modeling, Tech Shop, Coordinator of the Middle School Outdoor Education Program

Total Years Teaching Experience: 6

Degrees Held: BS Mechanical Engineering, Bachelor of Education

Signature of applicant

Date of Submission: May 1, 2018



Overview

It is likely that we are raising an entire generation of children who on the whole have little to no interaction with plants or connection to the earth as foundational food source. This reality, paired with the numerous opportunities for hands on learning that gardening provides, makes growing plants a natural fit for schools. In recent years, technology has been rapidly changing in the area of hydroponic gardening, and schools around the country are capitalizing on this new technology. This method triples the speed of growth versus outside, while using 10% of the water and space. There is less mess, hassle and cleanup as soil is not necessary, and the produce grown is fresh, delicious, and herbicide and pesticide free.

Environmental sustainability is an underlying theme in the the Middle School science curriculum, which has included a plant unit for many years. This year, in an effort to further our STEAM programming, a hydroponic gardening unit was implemented on a small scale with a system constructed at school. The unit was met with success as far as learning outcomes, and sparked a desire to expand the study of plants and gardening with a better system in future years. This proposal requests four Tower Garden systems, which are portable and will reside in the Library Learning Commons most of the time. These systems will allow the 7th graders to work on gardening throughout the year, on both experimental units carried out over several months, and year round food production for the dining hall.

Current Curriculum

In this 2017-18 academic year, students built and maintained a hydroponic gardening system comprised of buckets, drain pipes, pumps, fittings and clamps. They learned about pH as they conditioned the rock wool to make it suitable for sprouting seeds and about the plant needs and their lifecycles as they watched the plants grow. Over months, students collected data multiple times a week in order to answer, and provide quantitative evidence for the questions they developed, such as, "Does the use of grow lights in addition to ambient light help or hinder the growth of hydroponic basil?" Students determined what data to gather, how to gather it in an organized way and learned to take accurate measurements. Their analysis required spotting patterns, extracting useful information, averaging data and graphing trends. In addition to the rich skill development inherent in a long term scientific investigation, students went into more depth to examine details of photosynthesis, plant life cycles, and the interdependence between plants, humans and the planet. The entire unit was a great success with lots of hands on, experiential learning and student excitement not only in the 7th grade class but also for our 2nd grade and 5th grade visitors who came to see the project. These visits bridged a connection between the gardening program in the Lower School with our newer program in the Middle School, a connection that we would like to further even more with this proposal.



Enhancement of Classroom Experience

This was the first year introducing a hydroponic gardening project as a means to study plants and our homemade system was a great entry point. There was true merit to the unit of study but there is opportunity to make it richer. The Tower Garden hydroponic system would fulfill the departmental wish to expand the plant unit in 7th Grade Science with a system that is easy to use, efficient, and virtually foolproof in terms of food production capability. Students building the tower units, watching the plants grow and being integral in the whole plan-to-production process will open up so much room for student curiosity and questioning. There are authentic entry points to discuss both the science and the impact to their daily lives. For example as they set up the grow lights, discussions can turn to photosynthesis, which not only helps the plant store energy, but also is the method by which they get energy when they eat it for lunch. We could discuss the role of plants in removing carbon from our atmosphere and spark interest in the role of carbon in our climate.

Our proposed changes do not change our core learning outcomes, but rather provide substantial benefits in furthering the current program. We want to change how our students feel about their learning and to extend the influence of their learning outside of the classroom. With a highly visible, attractively displayed tool, housed in a public area, students will take even more ownership and pride in their work in growing plants, work they can share not only with the Brimmer community but with visitors to the school and with the broader world through social media. In our current curriculum, students were growing for the sole purpose of learning. With the new system, they will be growing also to share, foster community, and contribute to the food supply and health of our whole school. The plants they grow will be used by the kitchen to feed our community and the chef will help to provide input on the plants selected. The students will have a responsibility to deliver the goods as expected. The scale of project will be much larger, and the fact that they will be producing a consumable good changes the whole mentality around the project. We hope it sparks interest in the topic around the school. Corollary benefits include better environmental awareness and improved health. Growing locally reduces carbon footprint and helps students to become more aware of their own carbon futures, and children tend to eat the food that they help to grow, thereby expanding their palate for fresh vegetables and encouraging a healthy lifestyle.

Additional room for program growth lies in coordination with our Outdoor Education programming. In 2017-18 students worked at Natick Organic Community Garden. As we have already built this connection to a community partner and there is intention to continue this partnership, students will have the opportunity to consult experts about their own gardening pursuits. After having spent time with the hydroponic gardens, we envision students having meaningful debates about the advantages and disadvantages of each form of gardening with those gardening experts.

Summary of Unit Plan

In order to form a natural bridge between the Tower Garden projects and the 7th grade evolution unit, each student will research a plant to discover its evolutionary history, and then consider its suitability in an hydroponic system. Based off preliminary research and by consulting with kitchen staff and/or community experts, students will collaborate and choose plants for the garden and develop an aeroponic garden plan. During the more intensive study of plants in the seventh grade, two gardens will be dedicated particularly to scientific investigation. Students will be asked to develop a scientifically testable question, practice organization and care as they collect accurate data spanning multiple weeks, discern meaning from the collected results using

mathematics and graphical analysis, and communicate this information with clear scientific claims supported by evidence and reasoning. These results will be publicly displayed via the library gardens. Lessons on pollination, plant structures, plant life cycle, photosynthesis and cellular respiration will be built into the unit support a deeper reasoning to their scientific claims. Lessons around assigning variables, proper measurement, data analysis, data visualization, and presentation of findings will give students more confidence about relating their scientific ideas to each other and the public in meaningful ways.

Project Sustainability

Once purchased, the Tower Garden requires little maintenance to produce crops on an ongoing basis. The pumps require a monthly cleaning and the nutrient solution needs to be tested for Ph at least weekly. Occasional trimming of the roots is necessary, as is harvesting. Teams of 7th Grade students, under the guidance of Ms. Shannon and Ms. Dolan would be responsible for caring for the plants, harvesting the produce, and tracking growth. Materials such as nutrient solution, seeds, and rock wool (used instead of soil) can be purchased as needed and covered by the Science Department and Library budgets. Support from the Tower Garden company will be helpful should we need to troubleshoot any problems as needed.

Real Life Scenario

Two of the Tower Gardens will be designated for learning and experimentation and used for food production when possible. The remaining gardens will be dedicated primarily for food production for the entire year. Each garden is capable of producing twenty plants, and we are optimistic that we could grow all the herbs and a majority of the salad greens used by the school. After planting seedlings, food is ready to eat in about six weeks. Students would begin providing the kitchen with food around Columbus Day, and continue through the remainder of the school year, at which point they will be shut down for the summer, then reopened in the fall for another cycle of growth.

Budget

Item	Qty	Total Cost
Tower Garden Systems	4	\$2,215.00
Dollies	4	\$280.00
Grow lights	4	\$1000
Support cages	4	\$180
Pump timers	4	\$40
Rockwool cubes case	1	\$200
Net pot case	1	\$200
Nutrient Solution and ph testing kits		\$200
Total		\$4,315