Comparing Systems to Augment Plant Growth

Name of Project: Comparing Systems to Augment Plant Growth		Duration: 8 weeks
Grade Level(s): 1st Grade	Teacher:	Subject/Course/Unit: **Science** (plants, outer space) **Math** (3D shapes, data collection) **Social Studies** (needs vs. wants) **ELA/Writing** (observation journals) **Computer Science** (3D design)
Big Idea:	For this project, students will be observing how technology can improve upon our ability to grow plants. We will compare the rate and quality of plant growth when using a variety of tools to assist.	
Authentic Purpose: (Why does this matter to your students?)	This project addressed the need of food security, which is paramount to living a healthy life. Students will be able to develop an understanding that they are capable of growing food products.	
Future-Ready Competencies: _X_Collaboration ____Communication _X_Critical thinking/Problem Solving _X_Creativity & Innovation ____Other:	Objectives: 1. After learning about what living things need, students will be able to describe three resources that are necessary for a plant to grow. 2. When designing flower pots, students will be able to name relevant three-dimensional shapes. 3. Students will be able to identify the difference between a need and a want. 4. When observing plant growth, students will be able to document observations and collect growth data on a weekly basis.	
Project Statement: (Include: issue, problem or challenge; student role, purpose, beneficiary, and desired outcomes)	In this project, we sought to identify a role that technology could take to improve upon the growth of plants. The purpose of this project was to expose students to the advantages and drawbacks of technology, and to understand that certain systems will perform a task better than others. Students were the primary beneficiaries of this project, as they got to directly witness the project and also will be able to consume the foods that they have grown. Students' roles included learning about how plants grow, learning how to use 3D design software, designing 3D plant pots, planting seeds in soil, planting seeds in a hydroponics garden, watering plants regularly, documenting observations in their journals, comparing growth between systems, understanding needs versus wants, explaining how plant growth varies between Earth soil and Mars simulant, and advocating for food security. The desired outcome of this project is for students to witness plant growth across multiple systems and successfully have grown food plants that they are able to consume.	

Empathy Anchor: (How will students develop empathy and care about this problem)	Primary students are naturally curious about the world around them. This project de-mystifies the concept of plant growth, and makes students curious to learn how different variables will affect growth. Empathy is further built around the idea that students will be able to consume the foods they have grown, and if they commit themselves to the project they will be able to directly reap the rewards of it.	
Public Audience & Reveal: (Experts, audiences, or product users students will engage with during and at the end of project)	This project will be revealed during a showcase in early March. Students, parents, other teachers, and administrators will be invited to learn more.	
Knowledge Construction: (How are students going to construct content knowledge and practice it) Students will gain knowledge along the course of this project and have direct opportunities to practice it. Students will learn first about the needs of plants, and then will have the opportunity to demonstrate those needs by ensuring their plant has everything it needs to grow. Students will also learn about 3D shapes and 3D design, and will then practice using those elements to design their plant pots.		Student Assessment: Students will be assessed using their plant observation journals, as well as anecdotal observations on plant care.
Design Process: 1. Discover 2. Research & Empathize 3. Brainstorm 4. Choose 5. Build 6. Test 7. Communicate 8. Redesign	Describe what (& how) students are going to do in each step: **Discover –** students will begin the project by sharing things they know about plants, where we see plants, and how they might grow. Students will explore different types of plant pots, and consider the pros and cons of various designs. **Research & Empathize –** students will research what plants need to survive, and will learn about needs versus wants pertaining to food security. **Brainstorm –** students considered which 3D shapes would be needed to construct a plant pot, and initially worked independently to build a prototype model of a plant pot using play dough. Then, students worked collaboratively in teams to create designs for plant pots to be 3D printed. **Choose –** students compromised and settled on a plant pot design with their team. **Build –** we 3D printed plant pots for each student, and planted seeds in each one. We also assembled our hydroponics garden, and planted seeds there as well. We ensured our potted plants were in a variety of soils, some being in regular Earth potting soil, and others being in Mars simulant. **Test –** students watched as the seeds slowly came to life, and compared the efficiency of each system. **Communicate –** students logged observations in their journals, and are able to share these with their peers and other individuals. **Redesign –** students noticed that certain plant growth was limited due to pot size, and chose to transplant plants as necessary.	
Resources needed: (On-site people, facilities, tools, technology, materials, community connections)	NYS Standards (content + CS & DF): **Math:**	Student Reflection: Students were asked to continually reflect throughout the process of this project. Ultimately, students reflected on

- 3D printer + filament - Tinkercad design program - Hydroponics garden - Plant pots - Plant seeds	NY-1.G.2 Compose two-dimensional shapes (rectangles, squares, trapezoids, triangles, half-circles, and quarter-circles) or three dimensional shapes (cubes, right	the efficacy and efficiency of plant growth across various systems. Students noticed that seeds grown in our 3D printed