Don’t Waste Your Water Embrace Your Water

New Mexico
Supercomputing Challenge
Final Report
April 4, 2012
Team 104
Red Mountain Middle School

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Executive Summary:

The state of New Mexico is challenged with long droughts and water shortages. Typically, 50-80% of household wastewater is grey water from kitchen sinks, dishwashers, bathroom sinks, tubs and showers. The reason for conducting this experiment and designing this computer model is to show that grey water can be reused and is a safe alternative method to conserving water.

The computer program will model the recycling of grey water by using the program Star Logo TNG. This grey water computer model will be validated against data gathered from a real world experimental model. The grey water that we will be using for this real life experiment is liquid hand dishwashing soap and the liquid dishwashing soap and rinse aid used in our schools automatic dishwasher. The purpose of this experiment was to find out which type of liquid dishwashing soap would have the highest germination rate of pinto bean seeds. The end goal is to use this program in a subroutine for a larger computer model.

We intend to solve this problem computationally by showing that grey water recycled from our school cafeteria automatic dishwasher is safe enough to grow a small garden or school farm. Research shows that water used for washing dishes is safe to use on to plants. Garden plants can actually flourish on washing water or grey water because of the phosphates in it. In fact mild household cleaning supplies are excellent sources of nutrition acting as a liquid fertilizer for irrigation of trees, privacy hedge rows, and ornamental planter beds. The quality of grey water depends on what you put in it and how much it has been diluted. It is always best to use biodegradable cleaning products. Our real life experiment and computer model does prove that grey water is a safe sustainable, efficient, and cheap method in watering plants.

Introduction:

Agriculture is an important part of the nation's economy. Local farmers and ranchers grow food and fiber for people and animals around the state and nation. The state of New Mexico is in a sever drought and has a limited supply of water. Typically, 50-80% of wastewater is grey water from kitchen sinks, dishwashers, bathroom sinks, tubs and showers. Our goal is to prove that reusing grey water is an affordable, effective, safe, natural method to help save our Earth's natural water supply for ourselves and our future generations.

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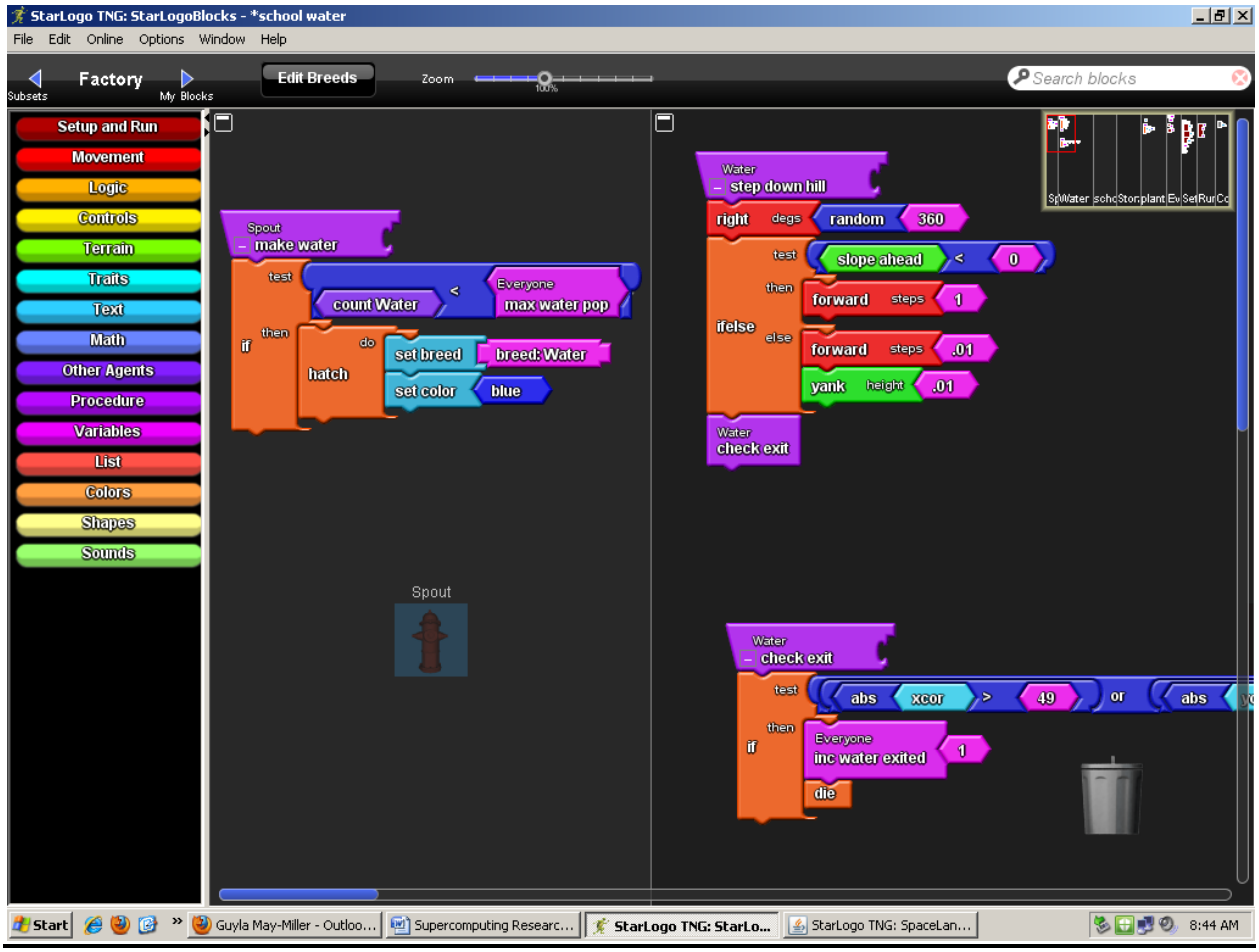
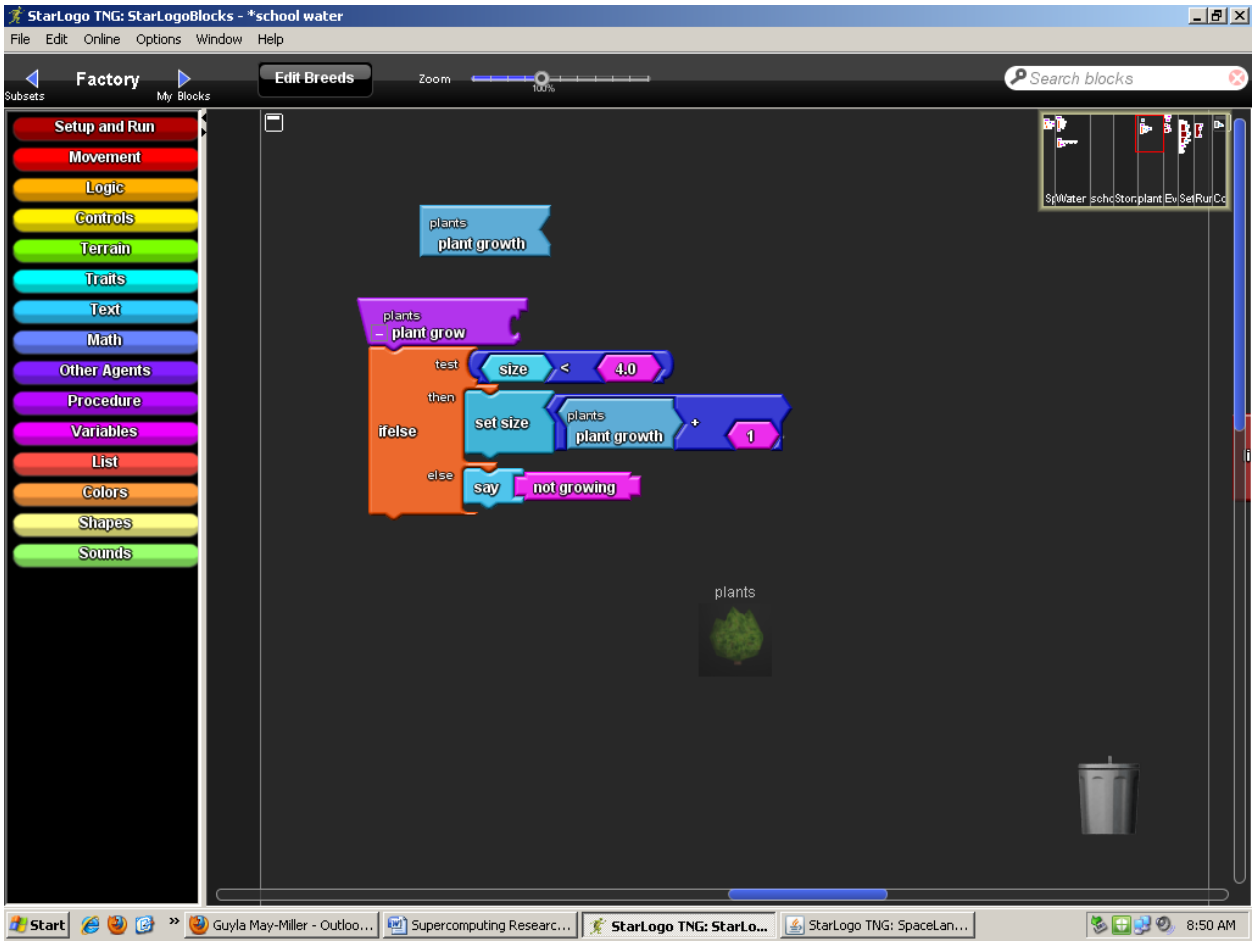
Description:

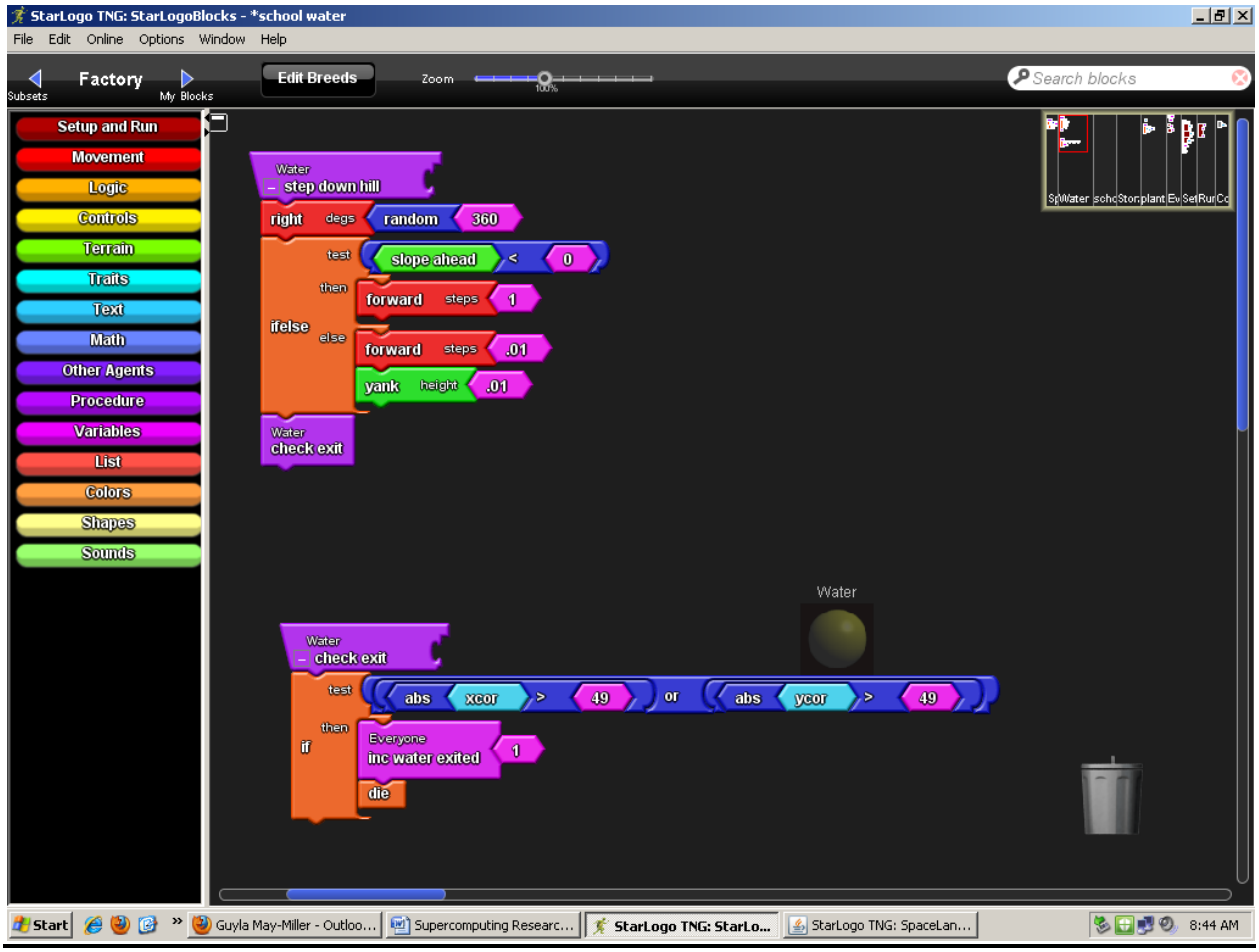
For the computer game we designed we added many parts that may not make sense but there is a reason for everything in the game. We added a school house to represent Red Mountain Middle School. We placed it there because our theme is small farms at the school using dishwater from dishes at lunch to water the plants. The pump house is what causes the water to come out of the ground pipes and water the plants. The water comes out of a big hill which causes it to flow down towards hundreds of plants. When the water touches a plant it causes the plant to grow and the water to deplete. The problem with this design is that the water was only directed to one plant which caused the plant to grow abnormally large and it depleted all the water so that none of the other plants could grow.



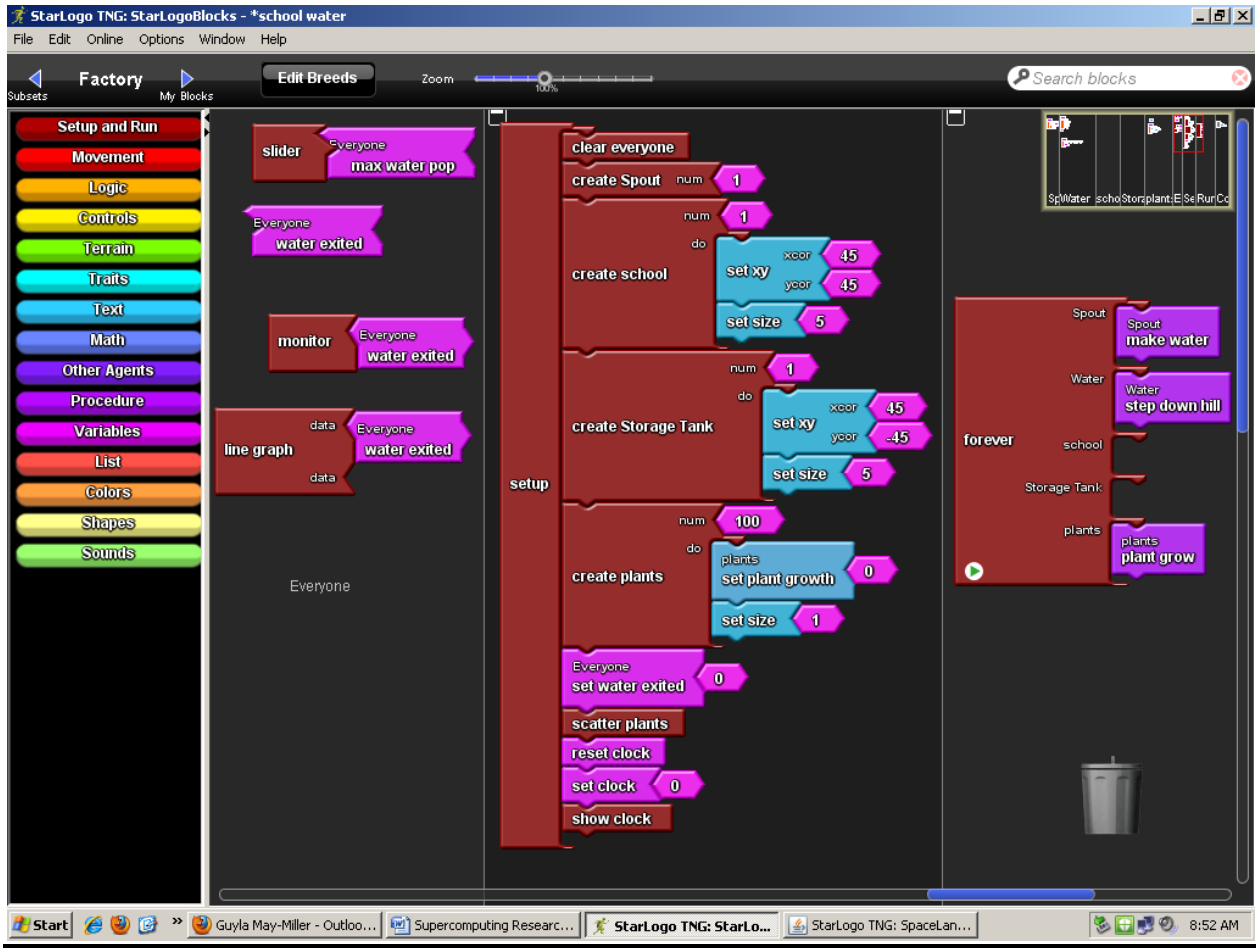
The computer program had to be redesigned by raising the sides of the terrain. We then placed four spouts on each corner and a spout in the middle of the terrain for the water to be equally distributed to all the plants. When water touches a plant, the plant then grows and the water molecules die out.



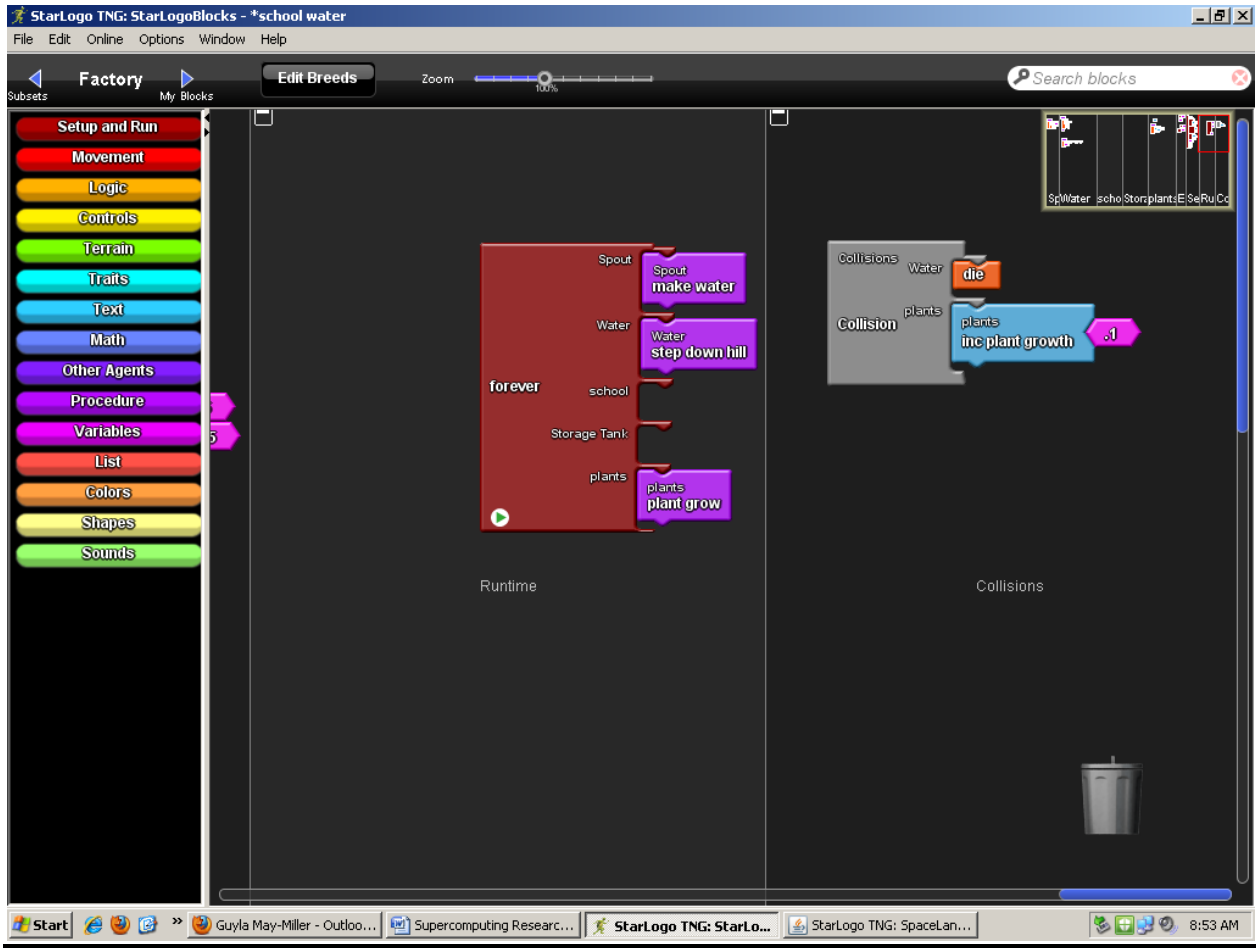
The problem that we encountered with our plants was that the plants closest to the water spout would be the only plants to receive water. The plant that was receiving the most amount of water would never stop growing and therefore it would be the biggest plant on the screen and would cause the other plants to not grow at all.



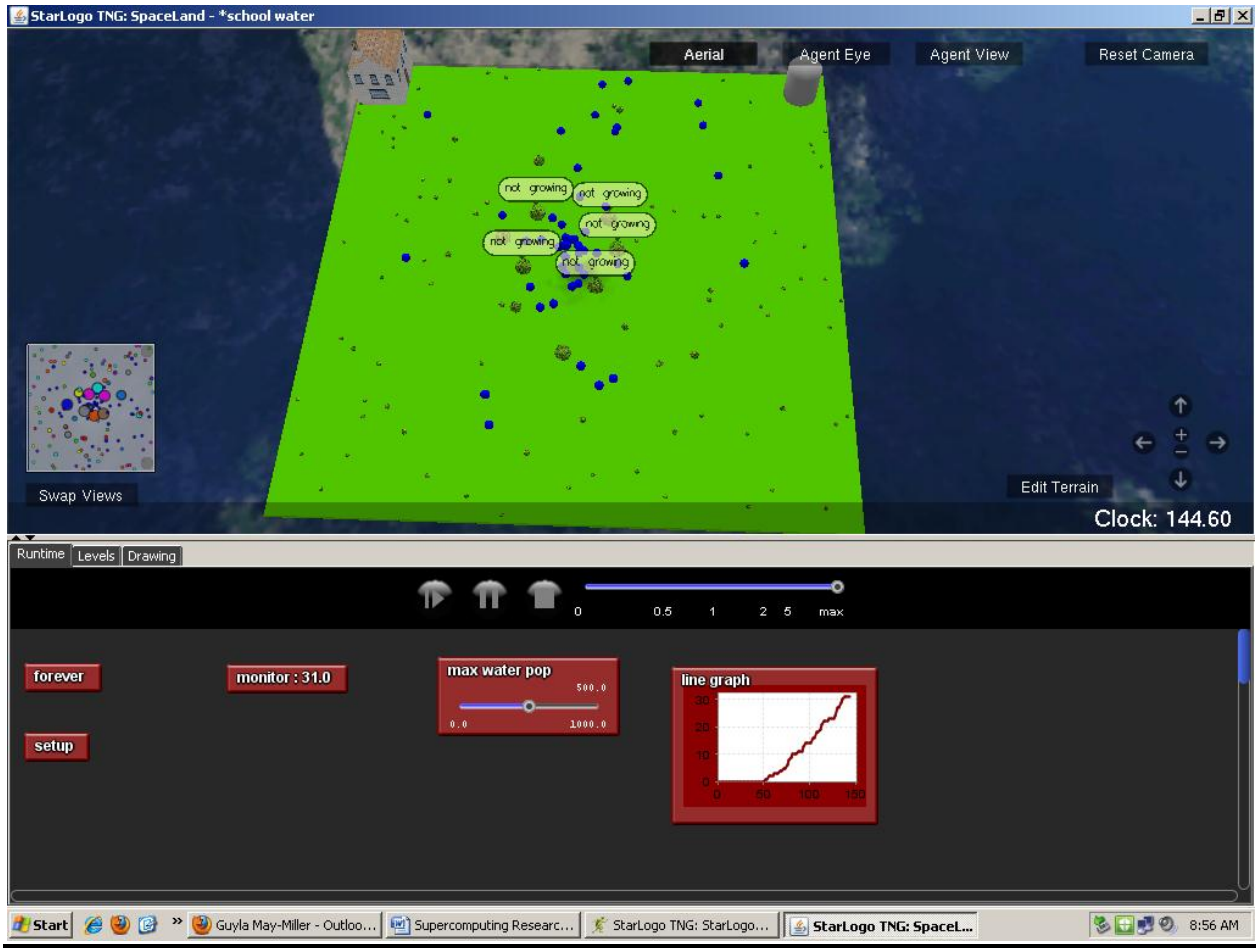
We did change the water spout back to the original place in the center of the terrain. We then assigned each plant a specific size that it could grow once the water reached it. After the plant reached its maximum height it would stop growing. Once the plant stopped growing the water would deplete.



We created a building that represented the Red Mountain Middle School and a storage tank the contained our school cafeteria dishwasher grey water. The purpose of this was to illustrate how the plants in the field will receive the grey water. We also tried to assign a mathematical formula to the water to collect data on our line graph but were not successful at doing this. We do plan on continuing to try this program until we accomplish this goal.



We created a run time for the water and plant growth as illustrated above. When water is released from the spout it is programmed to run down hill. Once the water collides with the plant the plant will grow to a certain height and the water will die. We had to create it this way because if not the plants would keep growing out of control. We also were trying to make it as similar to real life as possible.



Results:

The results from the real life experiment show that the distilled water had the highest germination rate with an average of 29 pinto bean seeds. The automatic dishwasher soap had an average of 17 and the rinse aid had an average germination rate of 16 pinto bean seeds. The liquid hand dishwashing soap Ultra Palmolive had the lowest germination rate with an average of 14 pinto bean seeds. Please refer to Appendix A through F for data tables and graphs.

The results from the computer model shows that once the water hits the plants it will eventually deplete causing the plant to only grow a certain height demonstrating real life experiences as seen on the screen above.

Conclusion:

Plants respond as well to dishwashing water or to water from an automatic dishwasher as they do to tap water. Most of the of the pinto bean seeds germinated on grey water although

some of the pinto bean seeds that were given the liquid hand dishwashing soap grey water were less vigorous and tended to not germinate as fast as the others.

Garden plants like phosphates, which are contained in water that has been used to wash dishes. Surfactants from such water can damage plants if they come into direct contact with them but they break down quite quickly in soil.

Recommendations:

Recommendations would be to use the grey water in different parts of the garden every few days, to allow dilution by rainfall or fresh water irrigation. Avoid contact between grey water and plants making sure that you are watering only the soil, and avoid using on acid-loving plants. . The quality of grey water depends on what you put in it and how much it has been diluted. It is always best to use biodegradable cleaning products.

Acknowledgements:

Mr. Navarrete- Designing the computer program & programming the code

Mrs. Miller- Writing Report & Technical Information

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Appendix A:

Total Germination Rate (Pinto Bean Seeds)

Test Groups:	Distilled Water: (Control)	Hand Dishwashing Soap: (Ultra Palmolive)	Automatic Dishwasher Soap: (School)	Automatic Dishwasher Rinse Aid
Day 1	12	3	6	1
Day 2	27	10	15	17
Day 3	36	19	22	22
Day 4	39	23	22	22

Average Germination Rate (Pinto Bean Seeds)

Test Groups:	Distilled Water: (Control)	Hand Dishwashing Soap: (Ultra Palmolive)	Automatic Dishwasher Soap: (School)	Automatic Dishwasher Rinse Aid
Average:	29	14	17	16

Appendix B:

Data Table Day 1: (12 hours)

Test Groups:	Water: (Control)	Hand Dishwashing Soap: (Ultra Palmolive)	Automatic Dishwasher Soap: (School)	Automatic Dishwasher Rinse Aid
1	2	1	0	0
2	2	1	4	0
3	1	0	2	0
4	2	0	0	0
5	1	1	0	0
6	0	0	0	0
7	1	0	0	0
8	2	0	0	0
9	1	0	0	0
10	0	0	0	1
Total:	12	3	6	1

Appendix C:

Data Table Day 2: (24 hours)

Test Groups:	Water: (Control)	Hand Dishwashing Soap: (Ultra Palmolive)	Automatic Dishwasher Soap: (School)	Automatic Dishwasher Rinse Aid
1	3	2	2	0
2	3	1	4	1
3	3	0	3	1
4	2	1	2	1
5	3	1	1	3
6	1	0	0	3
7	3	0	1	1
8	5	1	0	2
9	1	1	2	0
10	3	3	0	5
Total:	27	10	15	17

Appendix D:

Data Table Day 3: (36 hours)

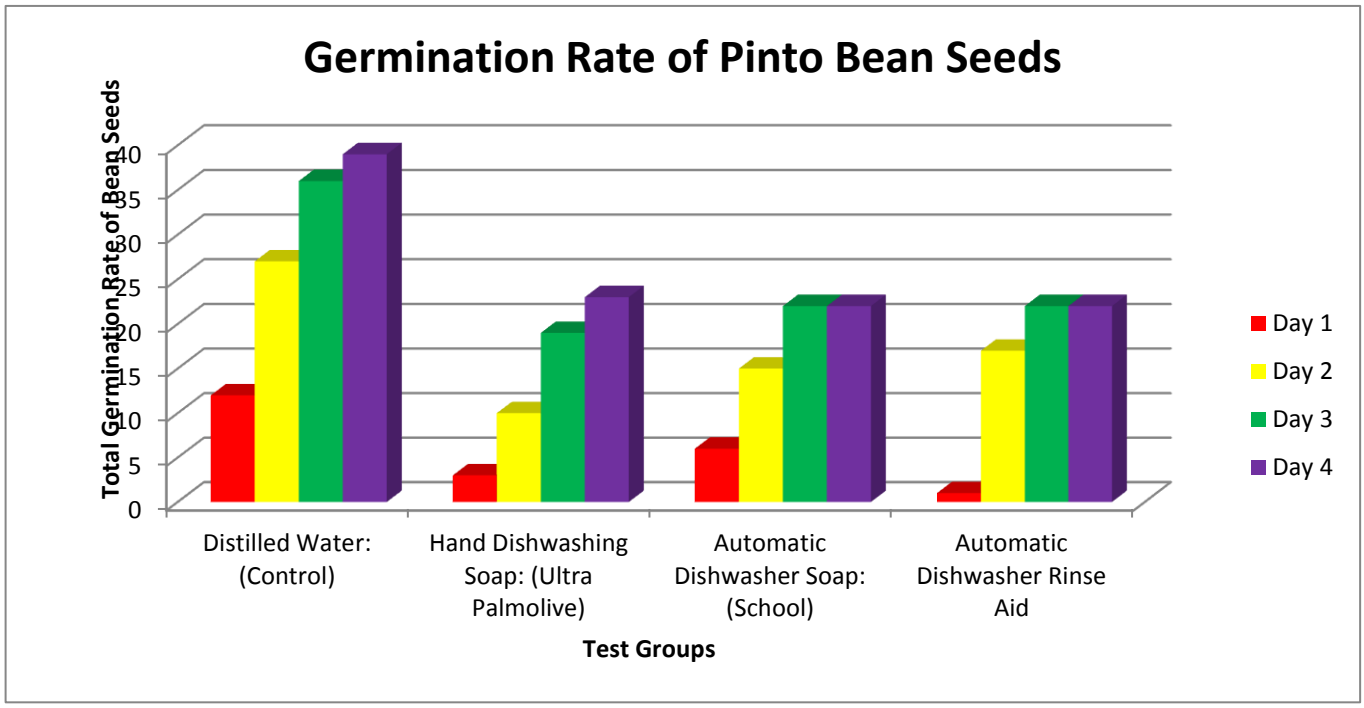
Test Groups:	Water: (Control)	Hand Dishwashing Soap: (Ultra Palmolive)	Automatic Dishwasher Soap: (School)	Automatic Dishwasher Rinse Aid
1	3	4	2	0
2	3	2	5	2
3	5	1	3	2
4	4	3	3	3
5	4	1	1	3
6	1	0	3	3
7	4	0	2	1
8	5	2	1	3
9	4	3	2	0
10	3	3	0	5
Total:	36	19	22	22

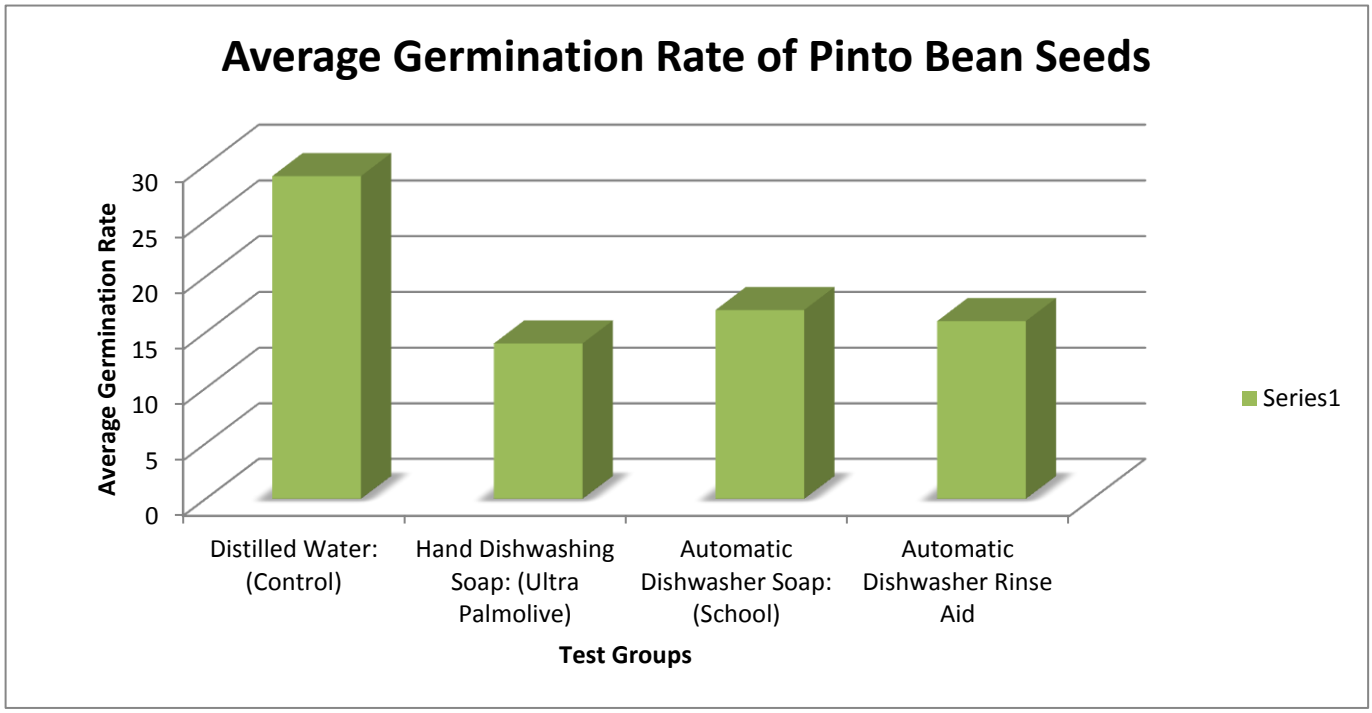
Appendix E:

Data Table Day 4: (48 hours)

Test Groups:	Water: (Control)	Hand Dishwashing Soap: (Ultra Palmolive)	Automatic Dishwasher Soap: (School)	Automatic Dishwasher Rinse Aid
1	3	5	2	0
2	4	3	5	2
3	5	1	3	2
4	5	4	3	3
5	5	1	1	3
6	1	0	3	3
7	4	0	2	1
8	5	2	1	3
9	4	4	2	0
10	3	3	0	5
Total:	39	23	22	22

Appendix F:


Germination Rate of Pinto Bean Seeds
Total Germination Rate of Bean Seeds
0
5
10
15
20
25
30
35
40
Distilled Water: (Control)
Hand Dishwashing Soap: (Ultra Palmolive)
Automatic Dishwasher Soap: (School)
Automatic Dishwasher Rinse Aid
Test Groups
Day 1
Day 2
Day 3
Day 4


Average Germination Rate of Pinto Bean Seeds
Average Germination Rate
0
5
10
15
20
25
30
Distilled Water: (Control)
Hand Dishwashing Soap: (Ultra Palmolive)
Automatic Dishwasher Soap: (School)
Automatic Dishwasher Rinse Aid
Test Groups
Series1