Using the Picaxe to Collect Data for Science Fair

Annotation

Samuel applies his knowledge of digital applications and systems to **develop a digital system** for **collecting, storing, displaying and analysing data** for his science fair project. Samuel creates a moisture detection system by using a breadboard, **input sensors**, a Picaxe **microcontroller** and **output sensors**. He **stores the data** gathered from the moisture detection system in a spreadsheet and then **graphs the data** to allow for **analysis of his results**. Samuel is able to use the results of his data analysis to **draw conclusions** for his science fair project. He has used G-Suite applications (Docs and Sheets) to document his science fair project. Through using these applications, he has demonstrated that he is able to **link and embed content,** as well as **use cloud storage to share content** with others (such as his teacher and peers).

In developing his digital outcome, Samuel is able to demonstrate understanding and application of:

- **creating, manipulating, storing, retrieving, sharing and testing content**
- **the particular roles of components in a fundamental input, process, output system and how they work together**.
- **how inputs are transformed into outputs within a fundamental system and the "control" role that humans have in this system**.
- **use of application software for a particular purpose**.

Background Learning

Samuel had learned how to create an input->process->output digital system using breadboards, input and output sensors and a Picaxe microcontroller chip during his Electronics Technology module. The students in the module learned how to gather data from input sensors, control the data with a computer program and output the data to a spreadsheet. Samuel's Science class had created microgreen green houses and used the digital systems developed in Electronics Technology to record and measure the temperature within the greenhouses in order to discover the optimal growing temperature for microgreens.

Task

The class was given the task of developing a scientific investigation for Science Fair. They were to develop their project aim, focus question, hypothesis, equipment list, method. Then they were to conduct their investigation and draw conclusions based on their investigation.

Student Project

Samuel's science fair investigation documentation is provided here and provides evidence of the learning annotated above.

Soiled Again
Soil Types and Water retention
By Samuel G

Aim:
To measure the moisture levels of sand, clay soil and water

Focus Question:
What soil type will contain the most moisture

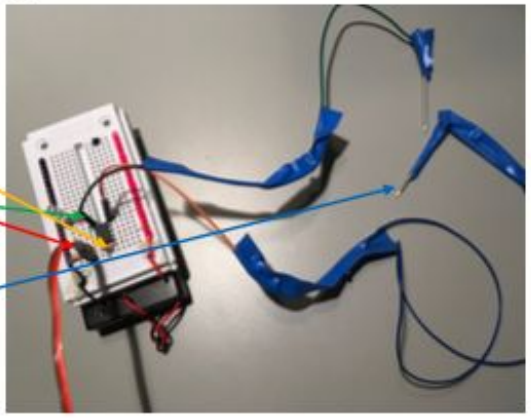
Hypothesis:
I think water will pass through sand easier than clay soil.

Equipment List:

- Breadboard
- 3 small plastic containers (size 20mls or bigger)
- 2 PICAXE Moisture Readers
- 20 grams of sand
- 20 grams of clay soil
- 1 breadboard chip
- PICAXE USB Download Cable
- PICAXE Chip-(08M2 08M2 18M2)
- MacAXEpad
- Code(Link)

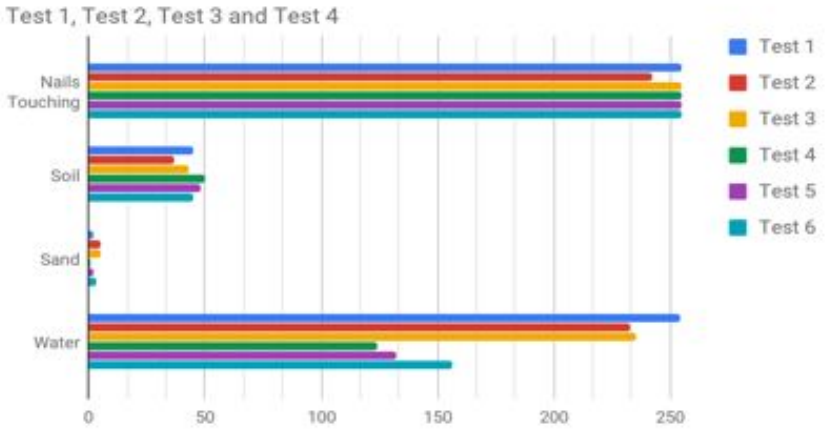
Method:

1. Label the 3 containers Sand, Soil and Water.
2. Put 20 grams of Sand into the Container labeled Sand.
3. Pour 20 mLs of water into the Container labeled Water.
4. Put 20 grams of Clay soil into the Container labeled Soil.
5. Grab your Breadboard and connect your PICAXE Chip into 18E and 18F
6. Connect your PICAXE USB Download Cable into 22H and 24H
7. Connect your PICAXE Moisture Readers into 5F and 5H
8. Open MacAXEpad and press File-New
9. Copy and paste the code into the workspace
10. Press F5 and wait until your code has been downloaded
11. Put your Nails (moisture readers) in the Water
12. Look at B1 and record results
13. Repeat step 11 but put your Nails in the Sand
14. Repeat step 12
15. Repeat step 11 but put your Nails in the Soil
16. Repeat step 12
17. After every day repeat step 8-16



My Data:

	A	B	C	D	E
1		Nails Touching	Soil	Sand	Water
2	Test 1	255	45	2	254
3	Test 2	242	37	5	233
4	Test 3	255	43	5	235
5	Test 4	255	50	1	124
6	Test 5	255	48	2	132
7	Test 6	255	45	3	156
8					



This Graph tells me that sand has the lowest moisture and the water has the most moisture. Nails Touching (control) was mostly similar but the water changed greatly over the tests. This tells me that sand is the best for drainage in your yard but clay soil is the best for water collection and growing vegetables that take a lot of moisture to survive.

Conclusion:
I think my science fair project was a success. My hypothesis was I think water will pass through sand easier than clay soil, was correct. The most trickiest part of my science fair project was getting the code correct so I could do testing, getting my logbook and writing up a conclusion. The easiest was converting my data into a graph. Other people will use this data to choose the right material to make a yard for quick drainage or planting vegetables.

What I did

By Samuel G

Week 2

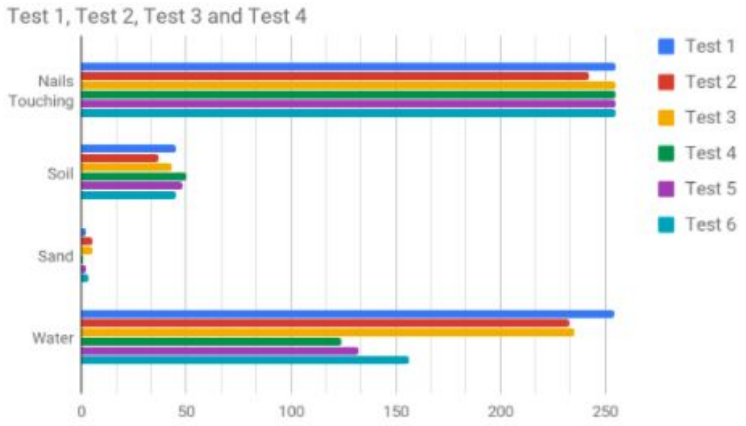
At technology in week 2 term 2 room 15 we were starting a greenhouse investigation to find out what was the optimum temperature to grow microgreens. I was put in a group to get codes to measure temperature and moisture when I thought of my science fair project.

Week 5

In Week 5 we had one person to update our codes in the design tech room in our inquiry times and because I was the person who was updating the codes I used that knowledge for my science fair.

Week 7

I started my testing with a breadboard for my Science fair. It took just under 1 week. (Spreadsheet of my data)



Teacher: *How does your system gather input?*

Samuel: The moisture sensors send input through the breadboard to the Picaxe chip. I used them to get moisture readings from different things like clay soil, sand and water.

Teacher: *How does your system give output?*

Samuel: The LED blinks out when it is reading data. When I press F5 the Picaxe chip sends its readings from the input on the screen.

Teacher: *What was the part of your system that did the processing of your data?*

Samuel: The Picaxe chip is the brain and does the processing. It followed the commands in my program that I downloaded to it. I told it to read in the data from the moisture sensors and show them on the screen.

Teacher: *How did you test your system to make sure if you were getting accurate data?*

Samuel: I did a few things to test my system. I used nails touching as a control because the nails touching should give a high reading. My tests showed that nails touching was always high. I also took readings on 6 different days so I could see if I was getting

readings that are similar each day. The only reading that changed a lot was water. I think it might be because I didn't put the nails in at the same angle each day or I used different tap water each day, so it might have different chemicals in it.