**Q405: Saturday Science**

**Session 2, Lesson 3**

**Lesson Topic:** Designing Various Circuits **Grade level(s):** 3rd-4th

**Instructor Names:**

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| **Desired Results** |
| **Overarching Focus Question for the Session** How can science help us to design art that lights up? |
| **Central Focus/Topic for today:*** Students will understand:
	+ How to use Microbits to design art that lights up
 | **Relationship that this central focus has to the overarching big idea/question for the unit*** Throughout these lessons, we have been building up to this point. They have learned about circuits (how they work, why they work, different kinds, etc.) so that they will be able to understand how science can help design art that lights up.
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| **Student objectives (outcomes):***.*Students will be able to: * Use the software, Microsoft MakeCode, to make their own code from Microbits
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| **Timeline of Activities for the Day** |
| \**Provide a breakdown of how long each activity will take, who will lead the segments of the activities, when breaks will occur or other transition points, etc.**\*Identify by highlighting in blue the portion of the lesson you team wants video-recorded each week. This should be ~45 mins*9:30-9:40→ Review Norms and Expectations 9:40-10:00→ Review of the past two weeks (what a circuit is, what they know it looks like, the different types)10:00-10:20→ Hand out a microbit to each pair and have them explore what it is, how it works and anything they can see about it10:20-10:40→ Snack and bathroom break10:40-10:45→ Head to the Computer Lab (room 2015)10:45-11:00→ Demonstration and explanation of the microbits and the idea of hidden circuits and how to properly code/coordinate. 11:00-11:40→ Microbit challenges 11:40-12:00→ Go back to classroom, wrap up discussion |
| **Learning Plan (First three E’s of the 5E model)***Any of these phases can be repeated should you have more than one activity to describe OR a complex activity with multiple iterations of some phases.* |
| **ENGAGE -** * Students will be asked to consult with their table partners and discuss what a series and parallel circuit are.
* We will then bring the class back together to review a simple, series and parallel circuit
	+ What is necessary to make each of them work?
	+ What is the difference between a series and parallel circuit?
	+ Why do they work?
	+ How do you know?
* Once students have been reminded of the last two weeks we will bring out the mircobits.
* We will pass out microbits to each pair of students and allow them to make their initial observations of the devices.
	+ What is it?
	+ What does it do?
	+ How does it work?
* After they have looked over the devices we will tell them what microbits are and what we will be using them for (creating art!) We will also tell the students that within each microbit is a circuit. Then we will ask:
	+ How can we tell what is in here if we cannot see it?
	+ How do you know that there is a circuit in there?
	+ What type of circuit do you think is within each microbit parallel/series? How do you know?
	+ Can it be multiple circuits inside it, or just one? Why do you think that?
* We will hand out paper/pencils to each student and ask them to draw what they think is present inside the microbits. Students will be allowed to work for 2-5 minutes then, we will show students a picture on the projector of what the microbit looks like. We will explicitly show them where all the metal parts connect to ensure that the power source transfers energy to the lights.

**EXPLORE -** * Before heading down to the computer lab, students will practice how to code.
* On the Mircobits website there is a section where there is a 4x5 sequence setting where students able to make their own design. To make sure they properly know how to code, we will have them practice on a 4x5 worksheet with letters on the X axis and numbers on the Y axis.
* We will give them different coordinates to make a design on their worksheet. This will show us if students will understand how to code properly on the computer when making their designs.
* Once students have completed their worksheets we will discuss as a whole group why coding is important, why do we need to know coordinates? What does this code say? Where else do you see coding occur? Do the coordinates have to be exactly right? What is the X axis tell us? What does the Y axis tell us?
* If students are confused on how to decode the picture, we will go over how to properly graph the coordinates all together. Then have them do the coding worksheet in pairs after explaining.
* After the coding activity worksheet, students will travel downstairs into computer lab 2015.
* Students will sit at their own computer for the remainder of the time in the computer lab.
* The teachers will do a demonstration on how to pull up the website and program the mircobit through the website.
* We will 5-10 minutes for the students to play around with their ideas on the website to get acclimated to the system.
* Students will be able to program the microbits using the website any way that they want
	+ Each pair will get a microbit, so they can program and then plug it in when they are done
	+ They can play around with it as much as they want until they have it programmed the way that they want

**EXPLAIN** * During this part, students will be explaining in groups of 4 what they coded on Mircobits did and how they created it
* They will plug in their microbits to show their group what they have done
* They will explain what kind of circuit it is and how they know
* We will explain why coding is important and how it is used in everyday life. Also, we will explain in greater detail if needed to about coordinating/coding on paper if students are confused. This will hopefully move them in the right direction when coming up with a design on MircoBits.

**ELABORATING/EXTENDING Understanding -** * During the last 15 minutes of the class, before parents come to pick up, we will discuss other devices that we encounter in our daily lives that involve circuits.
	+ What electronics come to mind that you think also involve circuits?
	+ If you had to guess, what types of circuits do we commonly use? Why do you think that?
	+ What would happen if the idea of circuits were never created?
	+ Do all types of electronics require circuits? How do you know?
* To end the day, we will play a youtube video that discusses how electrical circuits are used throughout our world on a daily basis. This will tie all of their knowledge together to show them how important circuits are in our daily lives, and how much more they could still learn!
	+ <https://www.youtube.com/watch?v=ngznoF6z0aw>
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| **Assessment Evidence (\*This is the Evaluation Phase of the 5E approach)** |
| **Performance Task(s):*** Create a functioning Microbit with the design of their choice.
 | **Other Evidence:*** Oral questions during classroom discussions, and listening in on table/partner group discussions.
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| **Materials + Quantity:*** All of the Microbits
* Computer Lab in room 2015
* 20 sheets of paper
* 20 pencils
* <https://www.youtube.com/watch?v=ngznoF6z0aw>
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| **Required Accommodations/Modifications:*** **Gear Up:** For students who are excelling, they can try to test out functions of the microbits that they did not test before. They can make the coding longer and see all of the different things that they can do with this technology (minus sound, since this requires extra steps)
* **Gear Down:** For students who are struggling with coding their Microbits, we will be going around and helping them. We can write down clear instructions for those who do not understand the functions on the website so that they are able to create their own artwork. We will all be circling the classroom to ensure that they know what they are doing and they are able to create the end product.
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| **Additional Modifications for Individual Students:** |