**WSU STEM Camp Module Using GRR**

**Bee-Bots**

Gabrielle Reese

**Minnesota State Science Standards:**

*Kindergarten*- 1.2.1 Students will be able to design and conduct investigations in the classroom, laboratory, and/or field to test students’ ideas and questions, and will organize and collect data to provide evidence to support claims the students make about phenomena

*Second-* 2.1.1 Students will be able to represent observations and data in order to recognize patterns in the data, the meaning of those patterns, and possible relationships between variables.

**Essential Question:**

How can we use Bee-Bots to fix bugs in our algorithms?

**Accommodations**:

Daily accommodations are listed at the beginning of each lesson. However, after student needs have been taken into consideration, additional accommodations can be made.

\*Notes:

* Duration times may vary. Allow for student led, academic discussions. Be aware of the time and plan accordingly.
* I, Gabrielle Reese, consent for this module to be used by WSU in the future.

**Day One**

Content Objective: The students will be able to define the term algorithm in their own words.

Language Objective: The students will be able to explain real-life examples of step-by-step instruction.

Materials: Movement cards, Command cards, White boards, “Funky Character” handout, (toothbrush & tooth paste optional)

Accommodations:

* Students who struggle with spelling or handwriting may draw their algorithms in pictures.

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| Introductions8:00-8:1010 minutes | As students walk in, they are instructed to choose a movement card then sit down at a desk.**We Do**: Go around the room and share your name, favorite summer activity, read chosen movement card for the class to do**I Do**: Morning MeetingDaily Call & Response (Students choice)* All set, you bet!
* Peanut butter, jelly time
* Macaroni and cheese, everybody freeze!

*Show me, with your fingers, a one if you would like “All Set”. Show me a two if you would like “Peanut Butter Jelly”. Or, show me three fingers if you’d like to do “Mac and Cheese” today.*Daily Expectations* Raise your hand
* Ask to use the restroom and never go alone
* Bee safe with Bee-Bots and writing utensils
* Have fun!
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| Objective8:10-8:1030 seconds | “Understand what an algorithm is and write your own”**I Do***: My goal for you today is by the time you leave today; you will know this big fancy word!* |
| Prior Knowledge/Informal Assessment 8:10-8:155 minutes | **We Do:** Teacher Led Discussion*Do you know how to follow directions?* *What are some directions you might hear at school? At home?**Would it be true if I said directions are kind of like step after step in order to accomplish something?**Have you heard of the word Algorithm?* |
| Intro8:15-8:205 minutes | **I Do**: Introduce Concept*Algorithms are step by step instructions. Much like the directions we hear at school or at home, these algorithms are instructions used to accomplish a goal. They are often used in computers and robots. Like out Bee-Bots over there! They need us to give them an algorithm in order for them to move!**\*if students are distracted by Bee-Bot, give them the opportunity to wave at them and say hello***You Do Together**: *Turn to your neighbor teach them how to brush their teeth. What instructions can you give for brushing our teeth?***We Do**: VocabHave students share their discussions/instructions with the class. Discuss how not taking the cap off of the toothpaste before squeezing it onto the brush would not work. *This is called a bug*. (Optional I Do: act out student’s algorithm for brushing teeth with a toothbrush and tooth paste to provide a real visual for a “bug” in their algorithm) |
| Brain Break8:20-8:244 minutes | *Let’s sing the algorithm song!* https://www.youtube.com/watch?v=cvk5vIgZAZw |
| Intro to Main Task8:24-8:3410 minutes | **We Do**: Funky Character Activity*I have written an Algorithm I want you to follow on your whiteboards. It’s an Algorithm to create a funky character. Here it is, get your markers ready!*[Circle for body, 2 eyes, crown, wings, 4 legs]*Every one’s character looks different! How can I change the algorithm to make it all the same?* (A: more detail) *I am going to give my algorithm more detail and let’s see if that makes our characters look more similar. Now, are they all going to be perfect? No, because we are humans not robots!*[small circle at top of paper; big square connected to the bottom of the circle, three small eyes, one arm on each side of the square, etc]*Do they look closer now? Yes!*  |
| Main Task8:34-8:4410 minutes | **You Do**: Funky Character Activity*You are going to create your own algorithm for your own character! Write or draw the five steps to creating your character, then the friend sitting next to you is going to follow your algorithm to make the character! Remember our expectations: have fun! Create a silly character!**Once you’re finished raise two hands, so I know.* |
| Reflection on Main Task8:44-8:528 minutes | **We Do**: Reflection Discussion*Did your character look like how you wanted it to? How can we change our algorithm, so our character looks how we intended?* *(Be more specific)* |
| Extra Time Activity | Add a few words to your instructions then have a new friend draw your character again. |
| ClosingAssessment8:52-8:553 minutes | **We Do**: Closing Discussion*What was that big A word? (Algorithm) What does it mean? (Step by step instructions) Do we follow algorithms every day? (yes) Everyday examples? (brushing teeth, getting dressed, making food)**Show me a three if you are feeling so confident in this algorithm thing! Show me a two if you are thinking this is kinda hard but I can do it!Show me a one if you are thinking I am excited to learn more tomorrow because I’m a little confused.* |

**Day Two**

Content Objective: The students will write algorithms using the Bee-Bot Command Cards.

Language Objective: The students will explain their reasoning for choosing the sequence of arrows they chose.

Materials: large command cards, green squares, red squares, white squares, command cards, paper bee-bots, Algorithm and Coder bands,

Accommodations:

* Students with low mobility can point to the direction the algorithm is stating and create the path using the colored squares on a desk.

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| Introductions8:00-8:055 minutes | **We Do**: Go around the room and share our name and favorite food. Students choose command card from the teacher’s deck, read it, and give it to the teacher who sets it aside**I Do**: Morning MeetingCall and Response for the day (Student choice)* All set, you bet!
* Peanut butter, jelly time
* Macaroni and cheese, everybody freeze!
* Flat tire, shhhh!

*Show me, with your fingers, a one if you would like “All Set”. Show me a two if you would like “Peanut Butter Jelly”. Or, show me three fingers if you’d like to do “Mac and Cheese” today.*Be sure to introduce the new call and response added to the options.Review Daily Expectations* Raise your hand
* Ask to use the restroom and never go alone
* Bee safe with Bee-Bots and writing utensils
* Have fun!
 |
| ObjectiveAssessment8:05-8:072 minutes | **We Do**: Brief Review + Objective*Who remembers the word we learned yesterday? (Algorithm) What is an algorithm?**Show me a thumbs up for true and a thumbs down for false: The steps to baking a cake is like an algorithm.*Objective: Write our own algorithms |
| Practice Algorithms8:07-8:125 minutes | **We Do**: Following Algorithm Activity*Stand up and put a green square where you are standing. Listen to my algorithm twice* [command cards chosen from students earlier in lesson; set cards up for students to see], *then act it out placing a white square for every step. Place a red square where you ended* [forward, forward, left, back] *Look where you started and ended. Does your path match my algorithm? Go back to the green start square and say the steps to the algorithm as you walk.* |
| Practice Writing Algorithms8:12-8:2210 minutes | **You Do Together**: Writing Algorithm Activity*Use command cards to write a four-step algorithm for partner to act out, use the colored squares to create a path for algorithm. This path with help you look out for bugs in your algorithms! The driver will point to the card, reading them out loud. The Bot will move and place the squares as the drive reads. After one algorithm, switch jobs*EX: F, F, B, R, = move forward two steps, back one, right one |
| Practice Writing Algorithms8:22-8:328:32-8:4220 minutes | **You Do Together**: Writing Algorithms to Get to a Destination*Use the command cards to write an algorithm to get your paper bee-bot to the destination; lay out all cards first then move bee-bot; work together and watch out for bugs!**Now, I am giving you another landmark. This landmark is in your bee-bots path. You need to experiment and find an algorithm that will get your bee-bot around the obstacle and make it to your destination.* |
| Reflection 8:42-8:453 minutes | **We Do:** Reflective Discussion*What happens when I make my algorithm but when I move my bee-bot it doesn’t stay on the path towards its destination? Is my algorithm correct? What is that called if it is not? (Bug)* |
| Practice Bee-Bots8:45-8:538 minutes | **You Do**: Tomorrow we are going to keep working on algorithms, but we are going to use robots! I am going to give you time to practice using the buttons on these Bee-Bots. They work the same way we made our directions to get to the end of the track with forward, backward, left, and right commands. However, these have a Go and Stop button. You need to type your whole algorithm first then press go.Rules:1. Hold carefully (2 hands).
2. Use on the floor.
3. Pick up if it hits an obstacle.
4. Do not push or pull the Blue-Bot or drive it like a toy car.
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| Assessment8:53-8:541 minute | *While you are handing me your Bee-Bot, I would like you to tell me the definition of an algorithm in your own words.* |
| Closing8:54-8:551 minute  | **We Do:** DiscussionWhat is an algorithm? (Step by step instructions) What does our algorithm have when it doesn’t work? (Bug!)  |

**Day Three**

Content Objective: The students will be able to locate and fix bugs in algorithms by using paths and command cards.

Language Objective: The students will be able to explain why their algorithm was not successful.

Materials: Bee-Bots, Paper Bee-Bots, Command Cards, Markers, 15cm squares of paper

Accommodations:

* Students who struggle with fine motor skills may struggle shuffling between thin command cards. Students may point in the direction the command card states instead.

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| Introductions:8:00-8:1010 minutes | *Welcome! Let’s sing our algorithm song!* <https://www.youtube.com/watch?v=cvk5vIgZAZw>**I Do**: Morning MeetingCall and Response for the Day* All set, you bet!
* Peanut butter, jelly time
* Macaroni and cheese, everybody freeze!
* Flat Tire, shhhh!
* All righty righty, I’m ready ready!

Today, we have two goals: * Learn how a Bee-Bot works (all the buttons and switches) and how to take care of it.
* Learn one way of taking turns with Bee-Bots: Timed Turns.

Review Expectations* Raise your hand
* Bathrooms: ask & never alone
* Be safe
* Have fun
 |
| Observations:8:10-8:155 minutes | **We Do**: Observations Discussion (Student Led)*What did we learn while playing with the Bee-Bots yesterday?**When did you use the clear button?**When do you press the go button? Before you’re finished with your code? After?* *What happens when you press go to early?* |
| Instruction8:15-8:205 minutes | **I Do**: *We have a set of instructions (algorithm) that we give our Bee-Bots. We want to make sure we give our Bee-Bots the full list of directions before we send them on their mission* *What if Mom told you to bake a cake but didn’t tell you what ingredients you needed? How would you feel?* |
| Familiarizing the Bee-Bot Buttons8:20-8:3515 minutes | **We Do**: Each student has one forward, backward, left, right, clear, and go card in front of them. Instruct students to hold up the card matching the screen. (Google Slide presenting each button, what they do, and when they are used in the algorithm) |
| Self-Assessment8:35-8:3530 seconds | *Show me how comfortable you are feeling with these buttons**Thumbs up- Very!Sideways Thumb- Comfy, but I might need refreshers on them.**Thumbs down- I’d like to go over them again.* |
| Practicing Testing Algorithms8:35-8:427 minutes | **You Do Together**: Testing Algorithms ActivityGroups of 3* Driver: presses the buttons
* Navigator: lays the cards out
* Debugger: Watches for bugs in the algorithm
* Everyone: Helps write the algorithm with command cards

*Move your bee-bot to where you think it will go, test it out, ask yourself did it work? Switch jobs* |
| Peek into Tomorrow8:42-8:453 minutes | **I Do:** Introduce Tomorrow’s Activity*We are going to practice using algorithms with a starting and ending point. We need to know the commands in order to get from start to end. What command would I give first if I wanted to go from the ship to the volcano? (On Google Slide)**You are going to create your own maps! First, we need landmarks. We are going to draw landmarks- anything you’d like! Maybe your house, the mountains, a forest!* |
| Work time8:45-8:527 minutes | **You Do**: Creating LandmarksBrainstorm landmarksQuick sketch |
| Review8:52-8:553 minutes | **We Do**: Review Discussion*What is an algorithm? (Step by step instructions) What does our algorithm have when it doesn’t work? (Bug!) How do you think we can we spot those bugs when we are going from one starting point to an ending point?*Assessment: *What is the most confusing part about these algorithms?* |

**Day 4**

Content Objective: The students will create an algorithm to get their Bee-Bot from one landmark to another landmark.

Language Objective: The students will explain why their algorithm is successful as well as the debugging process of creating the algorithm.

Materials: 14x14cmm paper squares, Bee-Bot grids, Bee-Bots Markers, tape, Certificate Sentence Starters

Accommodations:

* Students who struggle with fine motor skills may verbally share the definition of an algorithm in their own words.
* Students who struggle to hold writing utensils will be offered a larger square to draw their landmarks.

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| Introductions8:00-8:055 minutes | *Welcome! Let’s sing our algorithm song!* <https://www.youtube.com/watch?v=cvk5vIgZAZw>**I Do**: Call and Response for the Day* All set, you bet!
* Peanut butter, jelly time
* Macaroni and cheese, everybody freeze!
* Flat Tire, shhhh!
* All righty righty, I’m ready ready!

Review Expectations* Raise your hand
* Bathrooms: ask & never alone
* Be safe
* Have fun
 |
| Review8:05-8:1510 minutes | **We Do*** Define Algorithms
* Buttons Learned
1. Clear is first; go is last
* Starting and Ending points
* Landmarks

*Let’s brainstorm some landmarks we can draw for our maps!*\*Write student ideas on the board as a visual for students to refer to while working. |
| Work time8:15-8:3015 minutes | **You Do:** Draw landmarks on 14x14cmm squares + paste on map grid (one grid per group)https://toytheater.com/classroom-timer/ |
| Writing Algorithms to Reach the Landmark8:30-8:4010 minutes | **You Do Together**: (Groups of three) Each group member creates a starting landmark and a finish landmark. The driver, navigator, and debugger work together to create an algorithm that gets the Bee-Bot from start to finish for each members’ start and finish. |
| Share8:40-8:455 minutes | **We Do**: Each group shares one of their successful start to finish algorithms from one landmark to the other |
| Review8:45-8:505 minutes | **We Do**: *What was your favorite part? What was you least favorite part? What would make it even more fun? What’s one thing/your favorite thing you learned? What was that “A” word? What does it mean? When do we use algorithms* |
| Certificate/Summative Assessment8:50-8:555 minutes | **You Do**: Certificate Sentence FrameMy name is \_\_\_\_\_\_\_\_\_\_\_\_!I am an expert programmer who learned an algorithm is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.(Define in your own words) |