DASHing Your Way to Scratch Lesson Plan

General Information

Subject/Course	Mathematics (Computer Science/Coding)
Level	Introductory Level Coders (works well for grades 3-8 with some minor modifications)
Lesson Duration	About two 1-hour sessions
# of Participants	Works best with groups of 6-8 students
Materials Needed	• Ingredients to make Rice Krispies treats (Rice Krispies cereal, marshmallows, butter) • A microwave (for the Rice Krispies) • A DASH robot and iPad with the Blockly app (free) for each group of 6-8 students • Masking tape • Laptops with Scratch accounts

Learning Goals

Curriculum Objectives (Ontario)	• "identify and compare integers found in real-life context, add and subtract integers, using a variety of tools" (Grade 7) • "identify and describe various polygons (i.e., triangles, quadrilaterals, pentagons, hexagons, heptagons, octagons) and sort and classify them by their geometric properties (i.e., number of sides or number of vertices), using concrete materials and pictorial representations" (Grade 1) • "use a reference tool (e.g., paper corner, pattern block, carpenter's square) to identify right angles and to describe angles as greater than, equal to, or less than a right angle" (Grade 3) • "identify and compare various polygons (i.e., triangles, quadrilaterals, pentagons, hexagons, heptagons, octagons) and sort them by their geometric properties (i.e., number of sides;

	side lengths; number of interior angles; number of right angles" (Grade 3)
	• "estimate, measure, and record length, perimeter, area" (Grade 2)
	• "solve problems requiring conversion from meters to centimeters and from kilometers to meters" (Grade 5)
	• "solve angle-relationship problems involving triangles (e.g., finding interior angles or complementary angles) (…) finding supplementary angles or opposite angles (…)" (Grade 8)
Lesson Objectives	• Introduce students to giving "detailed instructions"
	• Learn to decode and find bugs in codes
	• Apply their knowledge of interior/exterior angles
	• Use coding language

Hook

Duration: About 10 minutes

The objective of the hook is to get students used to the idea of "detailed instructions" in a fun way. Set up your station for making Rice Krispies (or anything else that is a simple procedure- making a sandwich, brushing your teeth etc.) and either pick a student to be the "robot" or tell the students that you are the robot. Make it very clear to all the students that you have to give detailed instructions to the robot because they can't think for themselves, they are the brain! Once the robot is chosen, begin making the Rice Krispies following **only** what the students tell them to do. If they say "put the marshmallows in a bowl" but don't say "take the marshmallows out of the bowl" first, then keep the marshmallows in the bag. Students may laugh or feel frustrated at first but they will catch on very quickly. It is also very important the order of instructions is followed- if a student says "put the marshmallows in the bowl" and another says "open the bag of marshmallows" right after, follow that order! Whenever a problem occurs, use language like "debug" and "troubleshoot" in your conversations with the students, and encourage them to do the same! When this activity is complete (and students are munching on the Rice Krispies!) have a conversation with them about how they felt. Reinforce that it is normal to feel frustrated at first, however debugging and fixing your code makes your feel great! The great thing about coding is that you're supposed to make mistakes because that's where most of the learning happens!

Activity

Can be split up over 2 sessions, or cut down based on the needs of your class.

Duration	Activity
10 mins	This is an introduction to the DASH robot. With the tape set up on the floor (with marks every 10cm like a ruler) allow students to be able to spend some time to play with

	DASH's functions. Seeing the sequential instructions by playing with lights and sounds is a fun way to solidify that order matters!
5 mins	Spend time putting DASH on the number line and having him move to different points on the straight line. Discussion and reiteration of "debugging" and "detailed instructions in order" is very important. Start with putting DASH at 0 and asking the students to move him to 3. Because DASH moves in centimeters and the number line is in decimeters, student will have to convert units. It may come very naturally and they may not even realize they did it- **this** is when it is important to introduce to them that they are actually doing math within their coding. Continue doing this asking them to move DASH from positive to negative numbers. Again, point out that they just did integer addition and subtraction.
10 mins	Now that the students are comfortable moving the robot back and forth, ask them to make a square with a set side length. They will have to turn the DASH robot 90 degrees. Allow them to play around with the functions to make the activity more engaging (i.e. after every turn, have DASH light up a colour sequence).
10-15 mins	Now have the students create an equilateral triangle. Students will likely take the same approach to the square, but this won't work this time. Because DASH faces the outside, he will need to turn 120 degrees, instead of the anticipated 60 degrees. Students would not have noticed it with the square activity because the interior angle and exterior angle are the same. This is a good time to introduce this language and continue to use it throughout the session. Allow students to take any approach that comes most naturally to them—whether it is modifying the square code or starting a completely new code. Talk about what is happening every step of the way. If there is time, you can turn these codes into loops or functions and further introduce more vocabulary to the students.
5 min	Discuss with students what happened in all of the previous activities. Ask about new words learned, how they felt when their codes didn't work, etc. Reiterate the importance of debugging, and (maybe) using functions and loops to make your code easier to read. Also reinforce the fact that mistakes will happen often but you need to learn from them!
30-40 mins	Allow students to return to their desk and do the same activities above, but on Scratch. Students will likely run into the problem of Scratch not writing because many students will not think of using the "pen down" function. Reference the Rice Krispies activity and mention that robots cannot think for themselves so you have to tell them all the little details like "putting the pen down on the paper to draw something". Hopefully, at this point everything will click with the students and they will have their "aha" moment! Discuss again, the differences and similarities of Scratch and DASH!