Grade 7 Coding in Science

Experience 1: Getting Familiar with Coding

Grade 7 Long Range Plan Model 2, December

Students will explore foundational aspects of coding. The main focus is on block coding. One suggested resource that can be used is the micro:bit platform using MakeCode, however, any coding platform could be used. It is recommended to start with a block coding platform so that students experience a foundational understanding of coding and then other platforms can be used/introduced as per teacher professional judgement.

Overview of learning experiences – why these activities	This is an exploration of some of the foundational aspects of a block coding platform. Students will use this initial exploration to explore concepts from Strands C (Matter and Energy - Pure Substances and Mixtures) and E (Earth and Space Systems - Heat in the Environment). As well, exploration with the block coding platform that connects with aspects of Strand A STEM Skills and Connections. If the micro:bit platform is chosen, then the suggestion is to explore the platform both virtually and with a physical robot (if this is available through the school or school district). Grade 7 Long Range Plan Model 2, December
Prior Knowledge / Prior Skill Set(s)	Background Knowledge and Concepts (Teacher): • Teachers should be familiar with at least one block coding platform (such as the micro:bit) and the recommendation is for the teacher to do the task prior to exploring with the students. • Teachers should have some initial knowledge of the expectations from Grade 7 Strands C and E, with a particular focus on states of matter, changes of state, what causes changes of state (energy in the form of heat/thermal), the Particle Theory of Matter and vocabulary from the curriculum expectations (i.e. melting, freezing/solidification, evaporation/vaporization, sublimation, deposition, solid, liquid, gas, etc.)

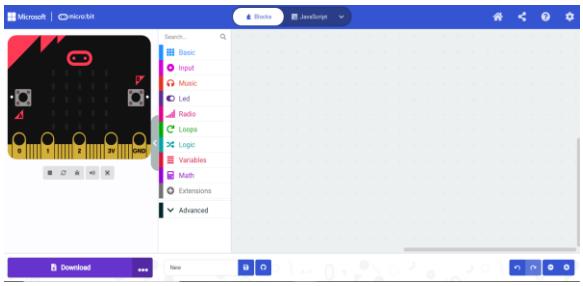
	Background Knowledge and Skills (Students): ● Students may have had some experience with coding/block coding and this will play a role in helping them with the tasks ● Background knowledge on concepts from Strands C and E will come from students' experiences from previous Grade levels and their own personal experiences.
Strand A - STEM Investigation and Communication Skills	A. STEM Skills and Connections  **A1.1 STEM Investigation and Communication Skills** use a scientific research process, a scientific experimentation process, and an engineering design process to conduct investigations, following appropriate health and safety procedures  **A1.3 Engineering Design (builds)** use an engineering design process and associated skills to design, build, and test devices, models, structures, and/or systems  **A.1.5.Communication** communicate their findings, using science and technology vocabulary and formats that are appropriate for specific audiences and purposes  **A.2 Coding and Emerging Technologies** use coding in investigations and to model concepts, and assess the impact of coding and of emerging technologies on everyday life and in STEM-related fields  **A3 Applications, Connections and Contributions** demonstrate an understanding of the practical applications of science and technology, and of contributions to science and technology from people with diverse lived experiences
Overview / Big Ideas/Fundamental Concepts	This exploration focusses on foundational aspects of a virtual coding platform (such as the micro:bit). The overall idea for this exploration is for students to work through teacher-directed/guided task(s) that will have students code. Examples of this type of coding could include a flashing and/or changing image, words, and letters, or movement of the virtual robot/interface in order to perform a task. An initial exploration into a block coding platform allows students to

	grasp the overall functions of the platform itself so that they can use this knowledge in order to code for specific concepts from Stands C and E. Please note that some students will already have a foundational knowledge of block and other coding platforms, which can be utilized to assist other students who may be in their initial explorations into coding. One recommendation is to work with these 'expert' students in order to drive some of the learning. The use of block coding in a virtual format permits equitable access for all students assuming computer and internet access at the school/school district. Students do not need to have one-to-one access to technology, as they can work as partners or small groups, with professional judgment at the educator's discretion.
Learning Goals / Success Criteria	Foundational understanding of block coding using a virtual coding platform/virtual robot (such as micro:bit), and aspects of the coding platform and functions. The micro:bit is one suggested platform as it is available FREE and does not need to be downloaded to any devices, it is web-enabled and accessible on computers, laptops, tablets, and smartphones. The suggested task using the micro:bit focuses on demonstrating coding knowledge on how to show a flashing image and then it further explores other aspects of the platform in order to code for other functions and students' own creations.
Learning Experience(s)  **A1.1, A1.3, A.2**	**Exploring A Virtual Coding/Block Coding Platform (Virtual Robot)** The focus here will be on the virtual block coding platform of the micro:bit. Any coding platform can be used for this initial exploration as the purpose is to provide foundational knowledge on block coding to the students on at least one platform so that they are familiar with the functions and overall commands. Beyond block coding could also be used for this initial exploration as per the foundational coding knowledge of the students. Using a virtual block coding platform such as micro:bit can allow for more equitable access to the software as it is FREE, does not require a download, and is accessible on almost all internet browsers and hardware items (computers, laptops, tablets and/or smartphones). Internet access is required to access the micro:bit platform.

Minds On

Introduction To Virtual Block Coding – example platform micro:bit (check out the Additional Resources section for online resources).

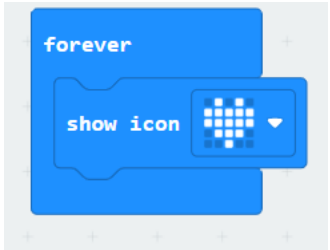
1. Virtual coding platform, go to https://makecode.microbit.org/
2. Select ‘new project’
3. The main coding area should now be displayed, which will look like the following:

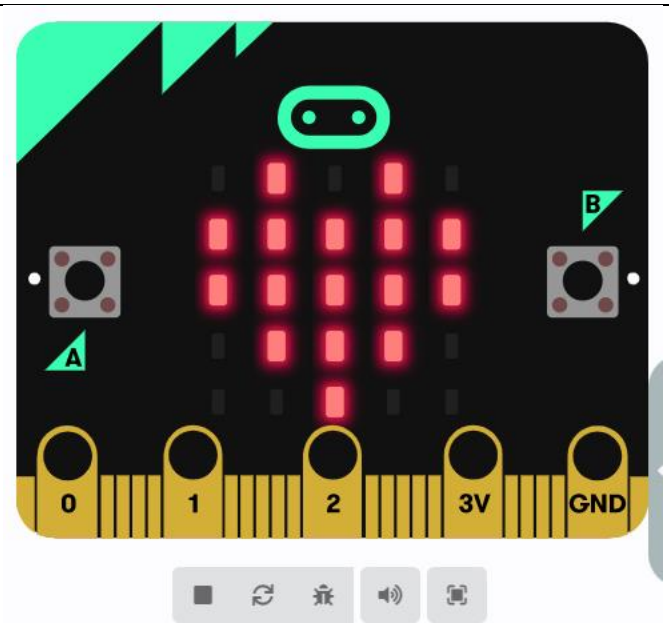


(English)

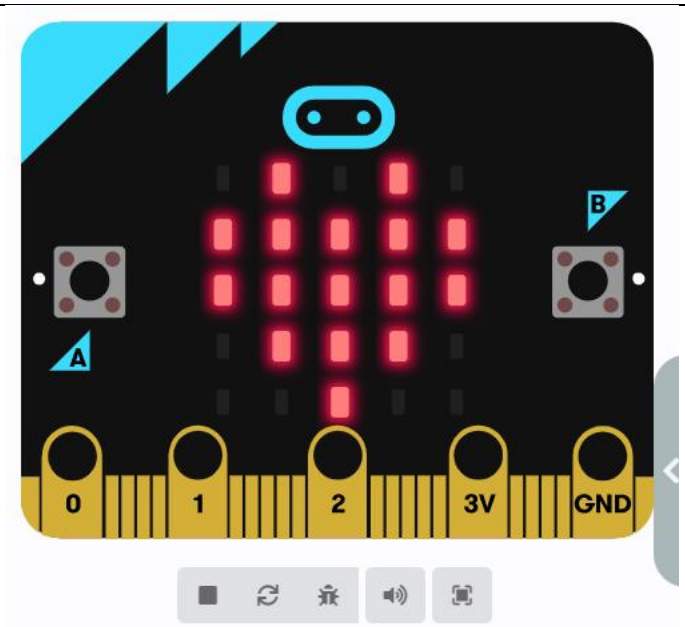
4. Select the ‘forever’ block from the coding space, this is the one that we are going to be using for this task.

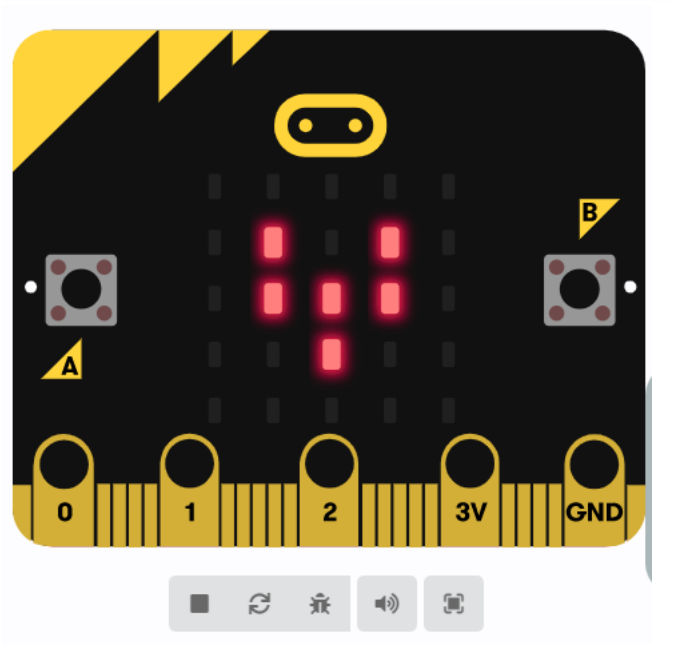
5. In the ‘basic’ menu, select the ‘show icon’ block and place it into the ‘forever’ block. You should now see a heart shape both in the ‘show icon’ and on the virtual LED display of the micro:bit.





6. In the ‘basic’ menu, select another ‘show icon’ block and place it into the ‘forever’ block under the current ‘show icon’ block. This time use the dropdown menu and choose a smaller heart image. Repeat this 3-4 more times. You should now see the heart flashing from large to small size on the virtual LED display of the micro:bit.





7. Have the students test out more features of the micro:bit code on their own, with a partner or in a small group. Ask them to test out the features. The main idea for this lesson/task is for students to become familiar with this block coding platform for coding. Please see the website links above for other possible tasks that could be completed by the

	students as well you are encouraged to create some tasks that suit the learning needs and learning styles of your students. 8. A possible extension for this task is to use the physical micro:bits which come with plugs and guides that provide instructions on how to use them. Essentially, the virtual LED display is the testing area and then they can download the code to the physical micro:bit.
Science and Technology Expectations	**Overall & Specific Expectations from the Science and Technology curriculum** **C. Matter and Energy - Pure Substances and Mixtures** C2. Exploring and Understanding Concepts demonstrate an understanding of the nature of matter, including the properties of pure substances and mixtures, and describe these properties using particle theory C2.1 demonstrate an understanding of the particle theory of matter C2.2 use particle theory to distinguish between pure substances and mixtures C2.8 describe pure substances as elements and compounds consisting of atoms and combinations of atoms **E. Earth and Space Systems - Heat in the Environment** E2. Exploring and Understanding Concepts demonstrate an understanding of heat as a form of energy that is associated with the movement of particles and is essential for many natural processes within Earth's systems E2.1 use particle theory to explain how heat affects the motion of particles in a solid, a liquid, and a gas E2.3 use particle theory to explain the effects of heat on volume in solids, liquids, and gases, including during changes of states of matter
Science and Technology Vocabulary	micro:bit - pocket-sized computer that can be coded using MakeCode which is a free online coding software Solid:

	The state of matter in which molecules are packed tightly together and vibrate in place. A solid has a definite volume and definite shape. Liquid: A state of matter in which the molecules of a substance are closer together but free to move relative to each other. A liquid has a definite volume but not a definite shape. Gas: A state of matter in which the molecules of a substance are widely separated and can move freely. A gas has no definite shape or volume. Conduction: The movement of transmission of energy through a substance. Convection: The circulation and accompanying heat transfer that occurs when a fluid that has been warmed from underneath rises, cools and then falls. Radiation: Emission or transmission of energy in the form of rays, waves, or particles.
Equipment and Materials	● Internet access to be able to access MakeCode online software ● Computers/tablets to access the MakeCode online software ● Physical micro:bits (this is recommended, but not required as the coding and testing can be done virtually on the MakeCode online software)
Timeline and Preparation	● There would be an initial setup time for the teacher to make sure that the classroom/students have access to appropriate technology such as the internet, computers/tablets as well as physical robots/technology (if the school has access to these) ● Recommended that the teacher explore the tasks prior to student engagement ● The lesson/task should take at least **1-2 working science classes/periods** or more, depending on the needs and learning styles of the students

	• Preparation for this lesson could take **40+ minutes** depending on what items are going to be used (i.e. the technology and possible physical robots)
Safety Considerations	• In terms of safety, it would be the standard safety as what your school/school district has provided in a regular classroom. • The use of the robotics kit is a form of technology with electrical components, so teachers need to remind students to be mindful. • There will also be wires and other types of connecting items so it would be advisable to setup the students in stations that are near wall/electrical outlets so that there is no tripping hazards • Working in small groups or with partners is recommended.
Opportunities For Assessment	• As this is an initial exploration with coding, teachers can use anecdotal or checklist-like assessment to make sure that students have worked through the components of the task. • A checklist or rubric that outlines what code was used, why the code was used, and the results of testing the code both for the code that is embedded in the slide deck and for other codes that students can use after. • See Appendix A: Evaluation Template for a general rubric template with reference
Instructional Strategies and Adaptability	• Students should know how to access the internet, with associated logins and passwords as well as how to access the technology at the school. • It may be of benefit to have strategic groupings of students throughout the exploration. • Some pre-teaching for students who have an IEP may be required prior to full class engagement. • Students who are ELL may benefit from translated materials and/or images and illustrations to help them.
Additional Supporting Resources	Introduction To Virtual Block Coding – example platform micro:bit with reference to the following online resource. Introduction to the micro:bit

Cross-Curricular Opportunities	This initial exploration with block coding provides the foundation for this type of coding with this software/hardware and can be easily connected to other curriculum areas. As the new revised Mathematics curriculum also has coding as part of the algebra expectations, this kind of task can be linked directly with this other subject area.
Future Opportunities / Next Steps	Challenge the students to explore and create other types of coding while using this software/hardware.

Appendix A: Evaluation Template

	Level 1	Level 2	Level 3	Level 4
Content	Does not convey the required information or understanding.	Shows some understanding of the subject.	Reflects understanding of the project.	Reflects understanding and synthesis of the subject.
Code Execution	Program does not work, or has major flaws that prevent its intended use.	Program mostly works and has only minor flaws.	Program works in the way the student intended.	Program is functional and refined, with extra features that exceed the requirements.
Code Practice	Program is difficult to read and contains lines that either do not work or are out of order.	Program can be read and is in a logical and/or sequential order.	Program is organized well and easy to read and understand.	Program is well organized, easy to read and understand and is efficient in the number of lines of code and/or timing of the code's execution.

Reference https://cdn-educators.brainpop.com/wp-content/uploads/2017/06/CreativeCodingRubric.docx.pdf