

Lesson 12

The Magic Box

Overview

Lesson 12 will introduce the use of variables. A variable can store and modify information and data. There are some built-in Variables blocks, for example, the “light intensity” Sensing block and the “answer” Sensing block. There exists a category called “Variables”, where students can create variables to store several data collected from, e.g., the “light intensity” and “answer.” Students will explore and experiment with the built-in Variables blocks and use them to create interesting projects.

Objectives

By the end of class, students will be able to...

- Understand the basic features of variables that a variable can store and contain different information and the information can be referred and modified later;
- Create looping and conditional algorithms with variables to develop interactive computing artifacts.

Materials

- mBlock
- Lesson 12 Activity Sheet
- Lesson 12 Slideshow

Content Standards

Type	Indicator	Standard
ISTE	1d	Students leverage technology to take an active role in choosing, achieving and demonstrating competency in their learning goals, informed by the learning sciences.
	3d	Students critically curate a variety of resources using digital tools to construct knowledge, produce creative artifacts and make meaningful learning experiences for themselves and others.
	5a, 5c	Students develop and employ strategies for understanding and solving problems in ways that leverage the power of technological methods to develop and test solutions.
CSTA	1B-DA-06	Organize and present collected data visually to highlight relationships and support a claim.
	1B-DA-07	Use data to highlight or propose cause-and-effect relationships, predict outcomes, or communicate an idea.
	1B-AP-09	Create programs that use variables to store and modify data.
	1B-AP-10	Create programs that include sequences, events, loops, and conditionals.

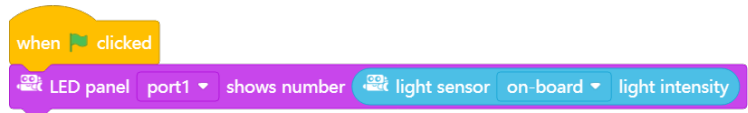
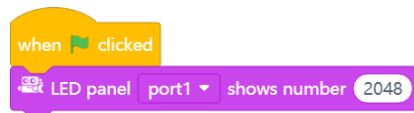
Vocabulary

Term	Definition
Variables*	A variable can hold different information and data and the value in it is changeable.

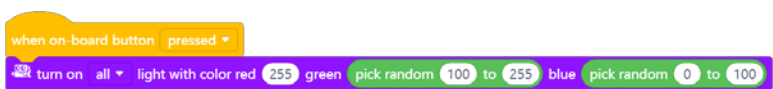
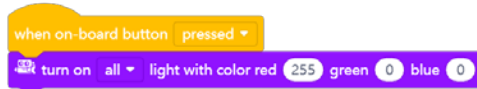
New Term*

Pre-lesson Checklist

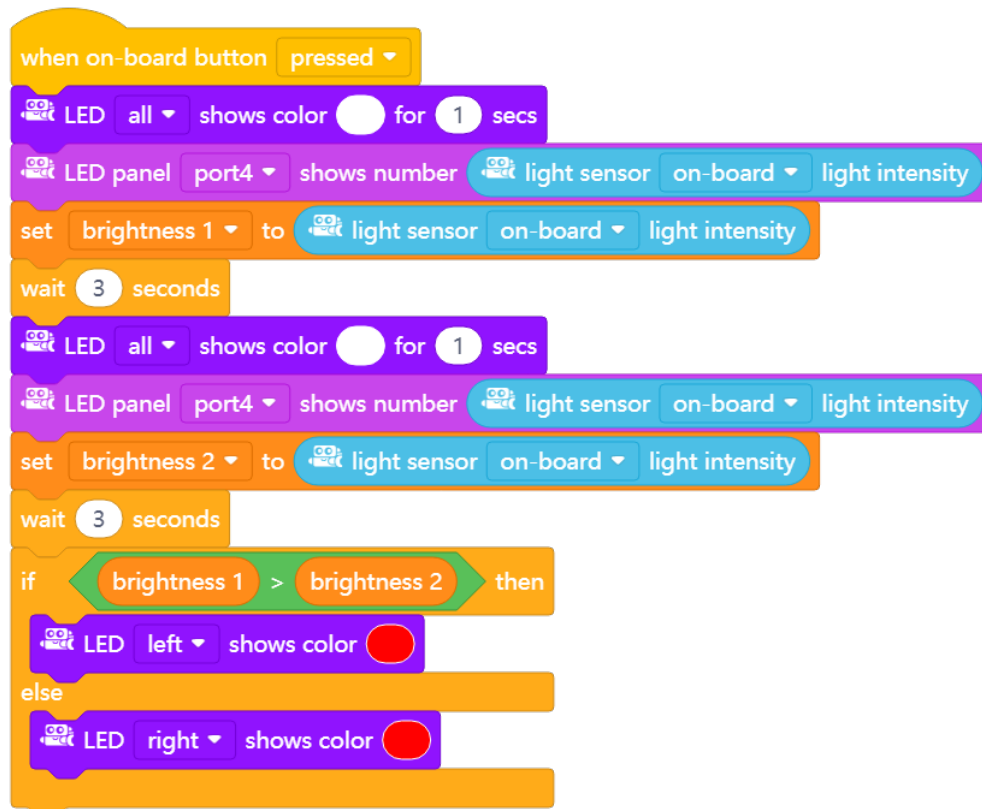
- Print out and/or digitally distribute the Lesson 12 Activity Sheet.
 - If students will use paper versions of activity sheets, make sure the resources are easily available for students. This can be done by providing the links on your LMS, etc., or printing the resources out for each group to utilize during the class.
- Make sure any necessary computer equipment (installed with mBlock) are ready to go.
- Familiarize yourself with key points and notes detailed within this lesson plan and Lesson 12 slideshow, as well as the demo programs:



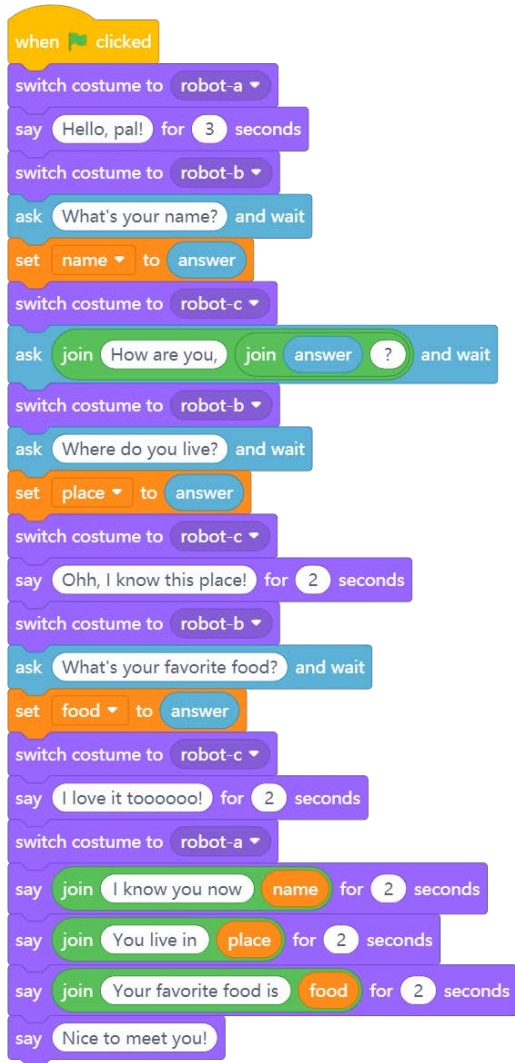
Task 12-1 Compare the Blocks You've Learned (Which number could change by themselves)



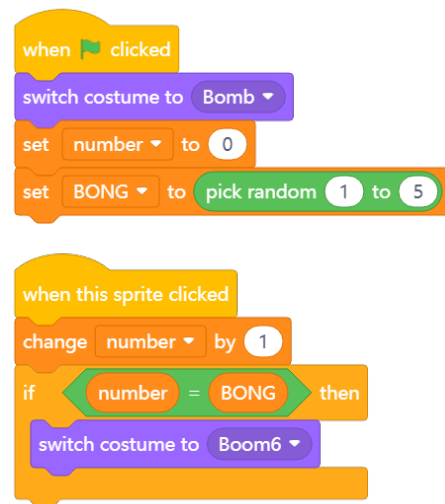
Task 12-1 Compare the Blocks You've Learned (Which LED light color could change by themselves)



Task 12-2 Demo Program of Compare Brightness Experiment



Task 12-3 Example of "My Story Bot"



Task 12-3 Example of "TICK-TICK-BONG"

Agenda (60 minutes)

Time Interval	Content
5 minutes	Warm Up This phase aims to contextualize the introduction to the variables in association with the example of the magician's box or hat.
15 minutes	Phase 1 This phase will introduce the concept of variables. Students need to recall some of the previous programs and identify the variables they have encountered.
15 minutes	Phase 2 In this phase, students will create variables block in the Variables category in the Blocks Area. Students need to use these variables to store and modify data.
15 minutes	Practice This phase is an open section for students to explore further to see how it is possible to use variables to create more interactive effects.
5 minutes	Wrap Up
5 minutes	Clean Up

 Activities

Warm Up: Slides 2-4 [10 minutes]

Objectives:

- This phase aims to contextualize the introduction to the variables in association with the example of the magician's box or hat.

Procedures:**Slide 2**

- Show Slide 2 to inform the class about the agenda and tasks in this lesson.

Slide 4

- Ask students to recall the magician's magic box or magic hat.
 - Emphasize that at the beginning, the box or hat is empty; however, the magician could hide a lot of things inside the box or hat, such as a rabbit, a bunch of flowers, cash, etc.
 - You could also use the scenario in the activity sheet of this lesson to begin this lesson:
 - *"Once upon a time, there was a magic box. The magic box could store anything you would like to place inside it – even though, it seemed that the magic box only had a very very tiny space. You were able to pick your things up at any time. Do you want to own the magic box that can store anything?"*

Phase 1: Slides 5-12 [15 minutes]

Objectives:

- This phase will introduce the concept of variables. Students need to recall some of the previous programs and identify the variables they have encountered.

Procedures:**Slide 6**

- Introduce the concept and use of variables.
 - Emphasize that a variable is like a shoebox, and different kinds of shoes can be put inside the shoe box and the shoe box can be renamed.
 - For example, a box that stores a pair of heels can be called "heels box"; a box that stores a pair of boots that can be named "boots box".
 - Even though the shoe box could be given different names depending on the types of shoes it holds; the shoebox is still a "shoebox" (it cannot hold food and be a "food box").
 - In programming, this kind of "box" is called a variable. It can hold data while programming.

Slide 7

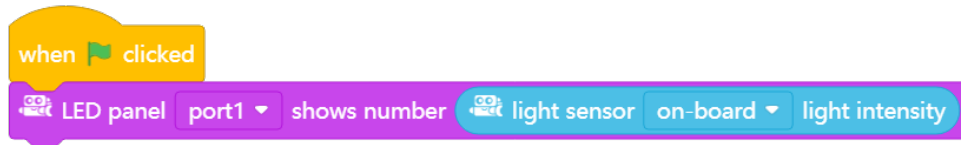
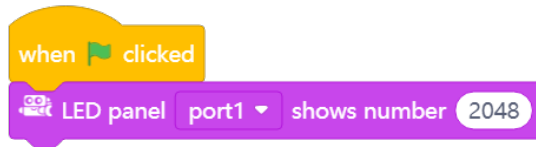
- Have students reflect on the "light intensity" block they have used in Lesson 3 and Lesson 11. The number of brightness can change due to the different environmental conditions (e.g. whether the light sensor is covered by a sheet or our hands).
 - Explain that the "light intensity" block is a variable because it stores different brightness data.
 - The "light intensity" block is a built-in variable, which means it can be used directly and there is no need to create it.

Slide 8

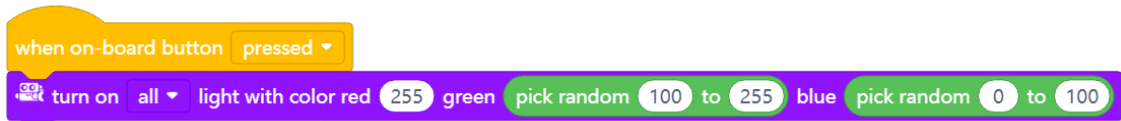
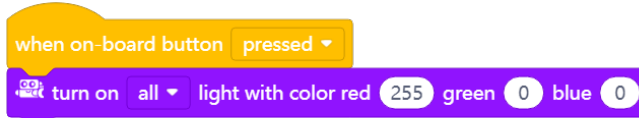
- Instruct students to complete Task 12-1 in the activity sheet

Slides 9-10

- Have students compare the groups of blocks:
 - Slide 9 focuses on the number displayed on the LED panel.
 - Students need to compare the two code to see which one can automatically change its number.
 - The first one would not change the number if no one types a new number in the script.
 - With regard to the second program, the number would change in response to the light intensity.



- Slide 10 focuses on the light color of the LED light bulbs.
 - Students need to compare the two code to see which one can change the light color automatically.
 - The first one would not change the light color automatically if the number indicators of the light color do not change.
 - With regard to the second program, the light color would change each time when the on-board button is pressed. The number indicator of the light color is defined by the random numbers that are produced by the computer.



Slides 11-12

- Summarize the features of variables:
 - "A variable has its own name – you can name a variable by yourself;
 - "A variable has a changeable value;
 - "A variable can be a text or number."
- Show Slide 12 to clarify what is meant by a variable can be the text or number.

Phase 2: Slides 13-19

[15 minutes]

Objectives:

- In this phase, students will create variables block in the Variables category in the Blocks Area. Students need to use these variables to store and modify data.

Procedures:**Slide 14**

- Instruct students to create a variable.
 - Have students find the Variables category and then click on the “Make a Variable” button on the panel.
 - A window will then appear and students can create a new block and give it a name (better give it a name that is easy to remember).

Slide 15

- Instruct students to complete Task 12-2 as well as to get familiar with how to use “Make a Variable”:
 - “In Lesson 3, you have conducted a brightness experiment.”*
 - “Can you make mBot compare two values and report the result?”*
 - “Use conditional algorithms and variables to program mBot, teaching mBot to report which situation is brighter between the two trials.”*
- Instruct students to create two variables:
 - For example, one is named “brightness 1” and the other is named “brightness 2”.

Slide 16

- Instruct students to define the rule:
 - If Trail 1 (or “brightness 1”) is brighter, light up the left LED bulb;
 - If Trail 2 (or “brightness 2”) is brighter, light up the right LED bulb.

Slide 17

- Instruct students to define the value, i.e., that is, what the variables “brightness 1” and “brightness 2” mean.

Slides 18-19

- Apart from defining the variables, pose questions for discussion:
 - “How to remind trail 1 and trail 2 (or to indicate the break between the two tests during your experiment)?”*
 - “What kinds of conditional construct would you use? Why?”*

Practice: Slides 20-26

[10 minutes]

Objectives:

- This phase is an open section for students to explore further to see how it is possible to use variables to create more interactive effects.

Procedures:**Slide 21**

- Have students reflect on their operation and experiment in the previous two tasks. Try to summarize what aspects could be applied to developing projects.
 - Ask students to consider, apart from the first task, what else could variables do?

Slides 22-23

- Display two examples to inspire students’ thinking: the first one is built on the chatbot project used in Lesson 1 and Lesson 2. The second one is a prototype of a time bomb to demonstrate how variables can make interesting games.

- The example program “My Story Bot” uses the pair Sensing blocks – “ask (...) and wait” and “answer” blocks – to fill in the “Say...” Looks blocks, and therefore, the chatbot is able to read and cite the name, the place, and the favorite food stored in the variables.
- The example program “TICK-TICK-BONG!”, on the other hand, use the “random number” blocks to select and define a “BONG” number at the beginning of the game – and of course, this “BONG” number will be stored in the variable.
 - Players take a turn to click the Bomb sprite, and a number will be produced each time when the sprite is clicked.
 - During this process, if the value number is equal to the “BONG” number, then the Bomb sprite will switch its costume to the “BONG” (“Boom”) one.
- With regard to the second example, encourage students to add more interactive effects (e.g., “tick-tick” sound and “BONG” sound).
- If students need some suggestions during this phase, you could choose to deliver the two demo program examples to students. Have them run the programs to see how variables are used in the programs. Then, encourage students to modify and enrich interactive effects.

Slide 25
- Summarize the key learning points of this lesson.

Wrap Up & Clean Up [10 minutes]