

Lesson 13

Benchmark III: The Time Machine

Overview

This lesson is a reflective learning activity to summarize the previous lessons. Students will continue their time travel narrative and design a Time Machine. Building on their expanding programming experience, students need to associate the possible time travel transportation with their everyday commute experience to think of the function and operation of Time Machine. Students will brainstorm and use sequential, looping, conditional algorithms as well as variables to turn mBot into a Time Machine.

Objectives

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

- Demonstrate the understanding and mastery of sequential, looping, and conditional algorithms within the context of an executable computing artifact;
- Use and create appropriate programming scripts to generate interplay between the hardware and the software.

Materials

- mBot
- mBlock
- Lesson 13 Activity Sheet
- Lesson 13 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.
	3c, 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.
	4a	Students use a variety of technologies within a design process to identify and solve problems by creating new, useful or imaginative solutions
	6a, 6d	Students communicate clearly and express themselves creatively for a variety of purposes using the platforms, tools, styles, formats and digital media appropriate to their goals.
CSTA	1B-AP-08	Compare and refine multiple algorithms for the same task and determine which is the most appropriate.
	1B-AP-13	Use an iterative process to plan the development of a program by including others' perspectives and considering user preferences.
	1B-IC-18	Discuss computing technologies that have changed the world, and express how those technologies influence, and are influenced by, cultural practices.

**Pre-lesson Checklist**

- Print out and/or digitally distribute the Lesson 13 Activity Sheet.
 - If students will use paper versions of activity sheets, make sure all 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 is ready to go.
- Familiarize yourself with key points and notes detailed within this lesson plan and the slideshow.
- If time and resources permit, you could choose to facilitate the context of “Time Machine” or “Time Travel” by engaging students in relevant literary texts and films.

**Agenda (60 minutes)**

Time Interval	Content
10 minutes	Recap • This phase aims to review what has been learned in the previous lesson. Students need to recognize and explain the basic concepts in their own words.
30 minutes	Challenge • In this phase, students will brainstorm the possible functions of Time Machine in the first place associated with their real-life commute experience. Building on the understanding of transportation in the actual world, students will imagine what can transfer to the design of Time Machine.
15 minutes	Share • This phase is to share, peer-review, and reflect upon the tentative animation. Students will evaluate and comment on each other's work.
5 minutes	Clean Up

Activities

Recap: Slides 2-6 [10 minutes]

Objectives:

- This phase aims to review what has been learned in the previous lesson. Students need to recognize and explain the basic concepts in their own words.

Procedures:

Slide 3

- Review the concept of conditionals.
- Pose the question for discussion:
 - "How do conditional algorithms improve the efficiency of operations?"*

Slide 4

- Review the use of logical operators that perform mathematics functions.

Slides 5-6

- Review the use of variables.
 - Have students recall previous learning activities and try to use their own words to explain the following questions:
 - "What is a variable?"*
 - "What can variables do?"*

Challenge: Slides 7-24 [30 minutes]

Objectives:

- In this phase, students will brainstorm the possible functions of Time Machine in the first place associated with their real-life commute experience. Building on the understanding of transportation in the actual world, students will imagine what can transfer to the design of Time Machine.

Procedures:

Slide 8

- Ask students to discuss what kinds of tools they would choose when going outside (somewhere near their houses and places far away from their living places, i.e., the spatial relationship that may affect the choice of transportation).
 - Pose questions for discussion:
 - "What kind of transportation do you use when going outside?"*
 - "Why do you use it?"*
 - Emphasize that students should clarify the place they want to go to.

Slide 9

- Show Slide 9 and ask students to discuss the following questions:
 - "What is the form of transportation in the picture? Did you use this tool before?"*
 - "When is it used? (Be specific with the location and distance)."*
 - "How does it work?"*

Slide 10

- Show Slide 10 and ask students to discuss the following questions:
 - *"What is the form of transportation in the picture? Did you use this tool before?"*
 - *"When is it used? (Be specific with the location and distance)."*
 - *"How does it work?"*

Slide 11

- Show Slide 11 and ask students to discuss the following questions:
 - *"What is the form of transportation in the picture? Did you use this tool before?"*
 - *"When is it used? (Be specific with the location and distance)."*
 - *"How does it work?"*

Slide 12

- Show Slide 12 and ask students to discuss the following questions:
 - *"What is the form of transportation in the picture? Did you use this tool before?"*
 - *"When is it used? (Be specific with the location and distance)."*
 - *"How does it work?"*

Slide 13

- Show Slide 13 and ask students to discuss the following questions:
 - *"What is the form of transportation in the picture? Did you use this tool before?"*
 - *"When is it used? (Be specific with the location and distance)."*
 - *"How does it work?"*

Slides 14-15

- Pose questions for discussion:
 - *"What if we want to travel to the future Robot World? What could we use? How might this tool look like?"*
 - Encourage students to discuss in their group and doodle imaginary transportation. Annotate the devices it had as well as the relevant functions.
- Show Slide 15 as an example of the imaginary transportation. Remind the class that the future transportation might not be necessary to have a very modern and technic outlook.
 - Have students share their creative ideas in front of the class and summarize that this kind of transportation could be called "Time Machine".

Slide 16

- Instruct students to use mBot to design time travel transportation. Emphasize that the focus in this phase of learning should be how Time Machine might work.

Slide 17

- Provide some possible suggestions for the class. For example, ask students to think of how they know whether a machine has been turned on or not.
 - Show Slide 17 to indicate one of the possible solutions – using a light indicator. Students can use LightSound blocks to program the LED bulbs in mCore.

Slides 18-19

- Suppose that possibly there might exist uncertain factors that could affect the traveling, ask students to think of possible solutions that could react to the possible accident.
 - Take the possible darkness as an example, ask students to think of how mBot could detect the brightness in the environment.
 - Ask students to think further about how the Driver could know the brightness.
 - Show Slide 18 to suggest a simple way by using mBot's LED panel as the output to display the value of the brightness in the surrounding.
 - Show Slide 19 to indicate another kind of advanced method by creating a variable block to store and transmit the data. If students choose to use this method, remember to choose the Live mode and enable the newly created variable for all the sprites.

Slides 20-21

- Ask students to continue to think of what should (or could) do next when detecting, e.g., it were too dark and dim to drive Time Machine.
 - Show Slide 20 to indicate a simple conditional construct for this case.
 - Show Slide 21 to indicate nested conditional algorithms for this case.
 - You can encourage students to talk about the advantages and disadvantages of using the two different kinds of conditional algorithms.

Slide 22

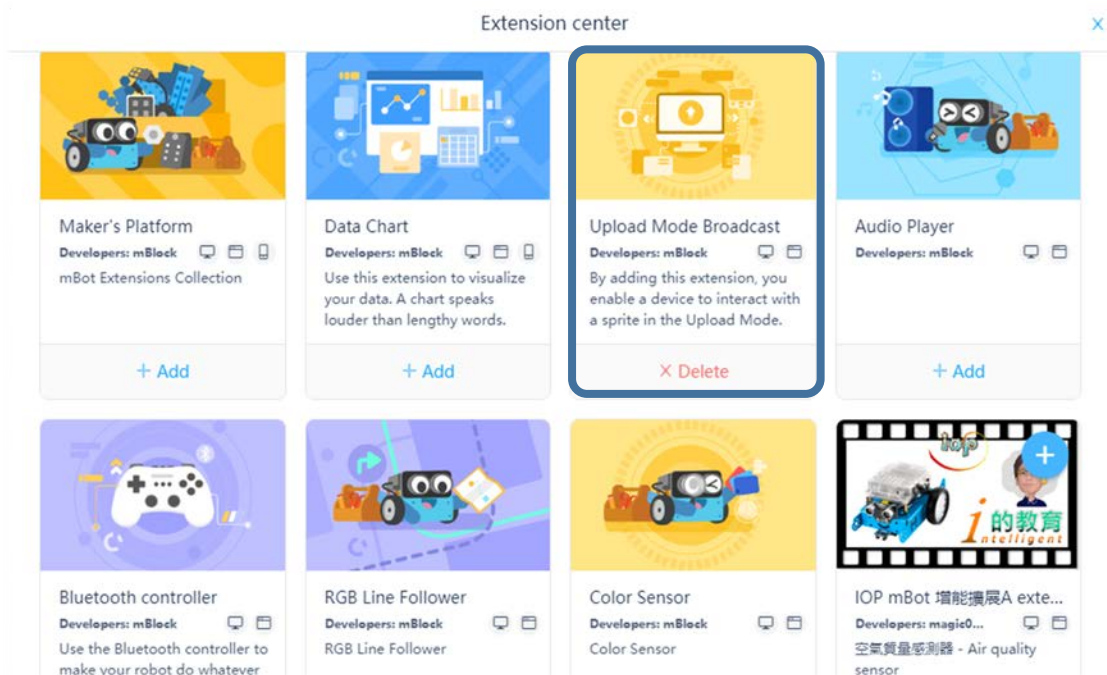
- Ask students to think of how Time Machine were possible to select the destination – that is, the year.
 - Remind the class that they could use the Morse Code as a means to select the destination of their time travel.

Slide 23

- Ask students to recall their chatbot project. Is there anything that can apply to this project?
 - For example, create another mBot sprite in the stage to ask the destination. Then, broadcast the message and make mBot's LED panel display the number of the year.

Slide 24

- Encourage students to explore how to design a virtual controller in the Stage Area to control mBot's movement in the physical world.
 - Depend on the Internet condition of your classroom, a simple way is to use the broadcast blocks and program the arrow sprites.
 - In this case, mBot is connected to the computer or laptop.
 - An advanced way is to add a category of new coding blocks in the Block Area in mBlock – the "Upload Mode Broadcast"
 - In this case, mBot can be used without a physical connection to the computer or laptop.
 - However, for beginner learners, this advanced tool is not compulsory.



Share: Slides 25-27
[15 minutes]**Objectives:**

- This phase is to share, peer-review, and reflect upon the tentative animation. Students will evaluate and comment on each other's work.

Procedures:**Slide 26**

- Ask students to share and invite at least two other classmates and the teacher to provide a score.
 - Explain the meaning and criteria for the evaluation. Make sure that students know that a "perfect 10" score is entirely possible!
 - Have students self-assess before they demonstrate in front of the class.
 - Students will be invited to explain their Time Machine design to the rest of the class.
 - Record and sum up the scores.
 - Meanwhile, have the presenter(s) choose one person (or more) to comment on their project (and write down the comments in the activity sheet).

Clean Up
[5 minutes]