

Exploring Computer Science is grateful to the Edison Robot team for creating this set of replacement lessons to support the transition from EdWare to EdScratch.

EdScratch for ECS

Replacement options

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About EdScratch

EdScratch is a vertical block-based visual programming language based on Scratch. The online EdScratch programming environment combines the ease of drag-and-drop programming with powerful functionality and versatility in an easy-to-use interface. EdScratch's intuitive layout and the simplicity of block-based coding makes EdScratch an ideal programming language for students to use while exploring robotics. Helpful features, like the built-in bug box, make the transition to using more complex programming structures approachable even with no prior robotics experience. The EdScratch online application is free to use and can be accessed at www.edscratchapp.com.

About the EdScratch lessons

The Edison robot team have created a set of lesson activities and complementary supporting information to support educators in using Edison robots and EdScratch to teach meaningful computer science. The full set of EdScratch lesson activities and

the EdScratch teacher's guide are available for free at <https://meetedison.com/robot-programming-software/edscratch/>.

The EdScratch lesson activities are organised into six units – from an initial preparatory unit to a culminating project-based unit – with each unit containing one or two lessons. Each lesson contains a mix of structured and open-ended activities designed to allow students to work independently. The EdScratch activities introduce key concepts and learning objectives and provide hands-on tasks to engage students in active exploration of the learnings.

There are three types of lesson activities: 'Let's explore' activities, 'Change it up' activities, and 'Challenge up' activities.

Let's explore activities – core learning

All 'Let's explore' activities are 'base' activities which introduce new concepts and explain key ideas. 'Let's explore' activities include explanations and guidance around the core learnings, then have tasks for students to complete. The tasks allow students to explore the concepts and skills being introduced.

Change it up activities – extension activities

'Change it up' activities are extension activities that reinforce skills and concepts that have already been introduced. While 'Change it up' extension activities do not introduce new material, they do offer new projects or tasks to try. 'Change it up' activities are generally less structured than 'Let's explore' activities but still include sufficient guidance and hints to help students undertake the tasks or projects.

Challenge up activities – extension activities

Similar to 'Change it up' activities, 'Challenge up' activities are also extension activities which expand on and reinforce the material that has been previously introduced. The tasks and projects outlined in 'Challenge up' activities are generally more open-ended and offer less structured guidance than 'Let's explore' or 'Change it up' activities.

EdScratch lesson activity replacement options

Following the release of the EdScratch programming language for the Edison robot, EdWare, the original language for the Edison robot, was retired. While the EdWare app is still active and available for use with no set time-frame for deactivation, the EdWare app will not be updated moving forward.

To ensure that ECS teachers and students have the best experience possible with Edison robots, we recommend replacing the EdWare lessons suggested in Unit 6 of the *Exploring Computer Science v8.0* with EdScratch alternatives.

The following is a list of our replacement recommendations. These lessons have been modified from *Exploring Computer Science v8.0* document to enable one-to-one replacement of the current material with the EdScratch alternatives.

Instructional Days: 4-5

Topic Description: Introduce the features of the Edison robot

Objectives:

Students will be able to:

- Identify the parts and features of the Edison robot
- Scan barcodes to the robot

Outline of the Lesson:

- Introduce Edison. Watch 'Meet Edison' video (15 minutes)
- Distribution of Edison robot (10 minutes)
- Get to know Edison (35 minutes)
- Scan barcodes to Edison and describe its actions (50 minutes)

Student Activities:

- Student groups work together to investigate Edison.

Teaching/Learning Strategies:

- Prior to the lesson, get setup by reading the 'Before you start' section of the Teacher's Guide to EdScratch (p. 12-13) and familiarize yourself with Edison by reading activity U1-1.1 *Let's explore our Edison robots* (p. 7-9) of the EdScratch Lesson Activities Set.
- Give each pair (or group of three) an Edison robot. Distribute and run activity U1-1.1 *Let's explore our Edison robots* with students. Point out the images illustrating where each sensor is on the robot. Have students follow along, pausing until each group has completed each task (identifying sensors and components, attaching the EdComm cable, turning the robot on, etc). Have students explain what happens when they turn the robots on.
- Distribute and run activity U1-1.2 *Let's explore barcode programming* with students. Have students analyze each barcode program by observing what the robot does. Groups should write a description of the robot's actions in each case and why the robot responds that way.
- While students are working, navigate the room asking students to explain the robot's actions. Ask students which sensors they think are being utilized and why.

Resources:

- EdScratch Lesson Activities Set (from <https://meet Edison.com/robot-programming-software/edscratch/>)
- Teacher's Guide to EdScratch (from <https://meet Edison.com/robot-programming-software/edscratch/>)
- 'Before you start' section of the Teacher's Guide to EdScratch, page 12-13

- Activity: U1-1.1 Let's explore our Edison robots (page 7-9 of the EdScratch Lesson Activities Set)
- Activity: U1-1.2 Let's explore barcode programming (page 11-14 of the EdScratch Lesson Activities Set)

Instructional Day: 6

Topic Description: Introduction to EdScratch

Objectives:

Students will be able to:

- Navigate the EdScratch programming environment
- Identify the four main parts of the EdScratch environment
- Load the Test_program in the EdScratch app
- Download a program to Edison
- Execute a program on Edison
- Analyze Edison's actions

Outline of the Lesson:

- Investigate the EdScratch programming environment (20 minutes)
- Download and analyze the test program (35 minutes)

Student Activities:

- Student groups navigate to the EdScratch programming site: <https://www.edscratchapp.com/>.
- Student groups will identify the four main parts of the EdScratch environment and explain their purpose.
- Students will create an account for EdScratch.
- Students will follow the steps to download the Test_program from the EdScratch app 'Demo programs' to the Edison robot.
- Students will investigate the Test_program by running the program on the robot and analyzing the code blocks that comprise the program.

Teaching/Learning Strategies:

- Students should create an account for the EdScratch app. Each student should load the Test_program from the 'Demo programs' in the menu. Students can save a copy of the program into their program files in their EdScratch account.
- After students have had an opportunity to investigate the EdScratch app environment, ask them to identify specific functionalities and specific areas of the app. For example, how do you save/open a program? Can you share your programs? Where do you modify inputs for a code block?
- Assign students to pairs. Remind students that in pair programming (from Unit 3 and Unit 4) one person is the "driver" and does the clicking and typing. The other person is the "navigator" and describes to the driver what to do at each step. Students should trade roles every 5-10 minutes. Keep track of the time and announce that students should switch at even frequencies. Make sure students trade and that both students are contributing equally.

- Each student should practice the steps to download the Test_program to the robot. (U1-2.1 *Let's explore the EdScratch environment* (p. 23-27 of the EdScratch Lesson Activities Set)
- Once students have successfully downloaded and executed the test program, have them modify parts of the program and observe the results. Can they get the robot to turn the opposite direction? Change the lights or beep sounds?
- While students are working, navigate the room asking students to identify similar programming constructs that they might have used in their Scratch projects. This will be the Journal prompt for the next day's activity.

Resources:

- EdScratch Lesson Activities Set (from <https://meetiedison.com/robot-programming-software/edscratch/>)
- Teacher's Guide to EdScratch (from <https://meetiedison.com/robot-programming-software/edscratch/>)
- Activity: U1-2.1 *Let's explore the EdScratch environment* (p. 23-27 of the EdScratch Lesson Activities Set)

Instructional Days: 7-9

Topic Description: Introduce robot movement and control

Objectives:

Students will be able to:

- Use sequential code to program the robot to drive forward, backwards and turn
- Modify the input parameters of code blocks to experiment with speed, time and distance
- Use code structures (waits, loops and interrupts) to control the robot's outputs
- Calibrate Edison's drive wheels

Outline of the Lesson:

- Journal Entry (10 minutes)
- Description of the assessment model (10 minutes)
- Calibrate Edison's drive wheels and test (5 minutes)
- Introduce lessons (10 minutes)
- Build and program robots according to tutorials (130 minutes)

Student Activities:

- Complete the journal entry.
- In groups of 2-3, students follow lessons to build and program small robots.

Teaching/Learning Strategies:

- Journal Entry: Identify similar programming constructs that they might have used in their Scratch projects.
 - Ask students to compare and contrast the similar constructs. How are they implemented in a program? How do they affect a sprite and robot? Do they have similar parameters? (Here is a great opportunity for a concept check: try to elicit the term 'parameter' through questioning.)
- Explain assessment model for tutorials. (Recommended: observe some but not all robots, look at the program as well as execution to determine grade.)
- Have students work in pairs or groups of three. Have one student in the group login to their account. (Students should share the programs with their partners when they are finished.)
- Pairs or groups will complete selected activities from Unit 2: Move it! and Unit 3: Got loops?
 - Activity: U2-1.3 *Let's explore driving Edison* (p. 43-44)
 - Activity: U2-2.1 *Let's explore Edison's outputs* (p. 47-50)
 - Activity: U2-2.2 *Let's explore input parameters* (p. 52-53) and U2-2.2a *Change it up: Teach Edison to count to 9* (p. 54-56)
 - Activity: U3-1.1 *Let's explore repeating steps* (p. 85-87)
 - Activity: U3-1.2 *Let's explore loops and sequence* (p. 95-96)
 - Activity: U3-1.3 *Let's explore forever loops* (p. 97-98)
 - Activity: U3-2.1 *Let's explore interrupting the main program* (p. 106-108) and U3-2.1b *Challenge up: Cheater bot* (p. 110)
- When students are testing their program, they may observe that Edison does not drive in a straight line, drifting to the left or right. Demonstrate how to calibrate the drive wheels

using the 'drive calibration' barcode. Have students calibrate and test the robot. Several attempts may be necessary to get the robot to move in as straight a line as possible.

- Use coloured tape on the floor and the appropriate 'activity sheet' as diagram guidance to make suitably larger testing spaces for robots as needed.
- Recommend that students experiment with their robots, for example, by adding additional code to their programs to include flashing LEDs, beeps or music.

Resources:

- EdScratch Lesson Activities Set (from <https://meetiedison.com/robot-programming-software/edscratch/>)
- Teacher's Guide to EdScratch (from <https://meetiedison.com/robot-programming-software/edscratch/>)
- Activity: U2-1.3 *Let's explore driving Edison* (p. 43-44 of the EdScratch Lesson Activities Set)
- Activity: U2-2.1 *Let's explore Edison's outputs* (p. 47-50 of the EdScratch Lesson Activities Set)
- Activity: U2-2.2 *Let's explore input parameters* (p. 52-53 of the EdScratch Lesson Activities Set) and U2-2.2a *Change it up: Teach Edison to count to 9* (p. 54-56 of the EdScratch Lesson Activities Set)
- Activity: U3-1.1 *Let's explore repeating steps* (p. 85-87 of the EdScratch Lesson Activities Set)
- Activity: U3-1.2 *Let's explore loops and sequence* (p. 95-96 of the EdScratch Lesson Activities Set)
- Activity: U3-1.3 *Let's explore forever loops* (p. 97-98 of the EdScratch Lesson Activities Set)
- Activity: U3-2.1 *Let's explore interrupting the main program* (p. 106-108 of the EdScratch Lesson Activities Set) and U3-2.1b *Challenge up: Cheater bot* (p. 110 of the EdScratch Lesson Activities Set)
- Activity sheets from Unit 2 (p.78-83 of the EdScratch Lesson Activities Set) and Unit 3 (p. 118 and 122 of the EdScratch Lesson Activities Set)
- The 'drive calibration' barcode and instructions (from <https://meetiedison.com/edison-robot-support/drive-calibration/>)

Instructional Days: 10-13

Topic Description: Introduce robot sensing

Objectives:

Students will be able to:

- Use the appropriate code blocks to program the robot to sense clapping, obstacles, and follow lines
- Modify the input parameters of code blocks to experiment with output effects
- Calibrate Edison's infrared sensors

Outline of the Lesson:

- Description of the assessment model (10 minutes)
- Calibrate Edison's drive wheels, infrared sensors and test (5 minutes)
- Introduce lessons (10 minutes)
- Build and program robots according to tutorials (135 minutes)
- Flash Talk Gallery Walk of demonstrating program modifications (55 minutes)

Student Activities:

- In groups of 2-3, students follow lessons to build and program small robots.
- Groups choose favorite modifications.
- A member of each group will demonstrate and explain a program modification to their assigned gallery walk group.

Teaching/Learning Strategies:

- Explain assessment model for tutorials. (Recommended: observe some but not all robots, look at the program as well as execution to determine grade.)
- Have students work in pairs or groups of three. Have one student in the group login to their account. (Students should share the programs with their partners when they are finished.)
- Pairs or groups will complete selected activities from Unit 4: What if...
 - Activity: U4-1.1 *Let's explore using conditionals* (p. 126-129)
 - Activity: U4-1.3 *Let's explore if statements and sequence* (p. 137-139)
 - Activity: U4-1.4 *Let's explore stacking and nesting if statements* (p. 140-143)
 - Activity: U4-2.2 *Let's explore Edison's line tracker* (p. 149-151)
 - Activity: U4-2.2a *Change it up: Drive inside a border* (p. 152)
 - Activity: U4-2.3 *Let's explore algorithms* (p. 153-155)
 - Activity: U4-2.3a *Challenge up: There's more than one way to follow a line* (p. 156-157)
 - Activity: U4-2.4 *Let's explore Edison's obstacle detection* (p. 158-160)
 - Activity: U4-2.4a *Change it up: Faster, faster, smash?* (p. 161)
 - Activity: U4-2.4b *Challenge up: If line, go right. If obstacle, go left* (p. 162)
 - Activity: U4-2.4c *Change it up: Where is the obstacle?* (p. 163)
- Demonstrate how to calibrate the infrared sensors using the 'calibrate obstacle detection' barcode (Appendix 2 of the Teacher's Guide to EdScratch, page 150). Have students calibrate and test the robot. Several attempts may be necessary to get the robot to set to the appropriate sensitivity.

- Recommend that students experiment with their robots, for example, by adding additional code to their programs to include flashing LEDs, beeps or music.
- Flash Talk Gallery Walk: Have student groups choose their favorite program modification from the selected activities. Divide the class into larger groups so that each gallery walk group includes a member of each team. Gallery Walk groups will rotate to each smaller group's robot. The team member for that robot will explain the program modification, demonstrate the robot, and answer any questions from their gallery walk group. Each "flash talk" will have a time limit of 3-4 minutes. Decide what is the appropriate duration based upon your class size and the number of gallery walk groups. Circulate the room to listen and observe as many "flash talks" as possible.

Resources:

- EdScratch Lesson Activities Set (from <https://meetedison.com/robot-programming-software/edscratch/>)
- Teacher's Guide to EdScratch (from <https://meetedison.com/robot-programming-software/edscratch/>)
- Activity: U4-1.1 *Let's explore using conditionals* (p. 126-129 of the EdScratch Lesson Activities Set)
- Activity: U4-1.3 *Let's explore if statements and sequence* (p. 137-139 of the EdScratch Lesson Activities Set)
- Activity: U4-1.4 *Let's explore stacking and nesting if statements* (p. 140-143 of the EdScratch Lesson Activities Set)
- Activity: U4-2.2 *Let's explore Edison's line tracker* (p. 149-151 of the EdScratch Lesson Activities Set)
- Activity: U4-2.2a *Change it up: Drive inside a border* (p. 152 of the EdScratch Lesson Activities Set)
- Activity: U4-2.3 *Let's explore algorithms* (p. 153-155 of the EdScratch Lesson Activities Set)
- Activity: U4-2.3a *Challenge up: There's more than one way to follow a line* (p. 156-157 of the EdScratch Lesson Activities Set)
- Activity: U4-2.4 *Let's explore Edison's obstacle detection* (p. 158-160 of the EdScratch Lesson Activities Set)
- Activity: U4-2.4a *Change it up: Faster, faster, smash?* (p. 161 of the EdScratch Lesson Activities Set)
- Activity: U4-2.4b *Challenge up: If line, go right. If obstacle, go left* (p. 162 of the EdScratch Lesson Activities Set)
- Activity: U4-2.4c *Change it up: Where is the obstacle?* (p. 163 of the EdScratch Lesson Activities Set)
- Activity sheets from Unit 4 (p.181-183 of the EdScratch Lesson Activities Set)
- The 'calibrate obstacle detection' barcode (p. 150 of the Teacher's Guide to EdScratch)