

SCENARIO

Title	FIRST DEGREE EQUATION - PROBLEM 1	
Summary	This activity consists of the calculation of first degree equations, with the aim of facilitating students' understanding of mathematical problems.	
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DIDACTIC OBJECTIVES

- Teach math in a different and attractive way.
- Teach first degree equations.

Physics Mathematics Information Technology Robotics Programming

Education Level: 10-12 years 12-14 years

PROBLEM STATEMENT

Some students have problems understanding the concept of what the mathematical problem asks, so through a visual example it is intended to facilitate learning and understanding.

BOM (Bill Of Materials needed)

- Arduino Device
- Board
- (x2) Leds (Red and Green)
- (x3) Cables
- (x2) Resistors

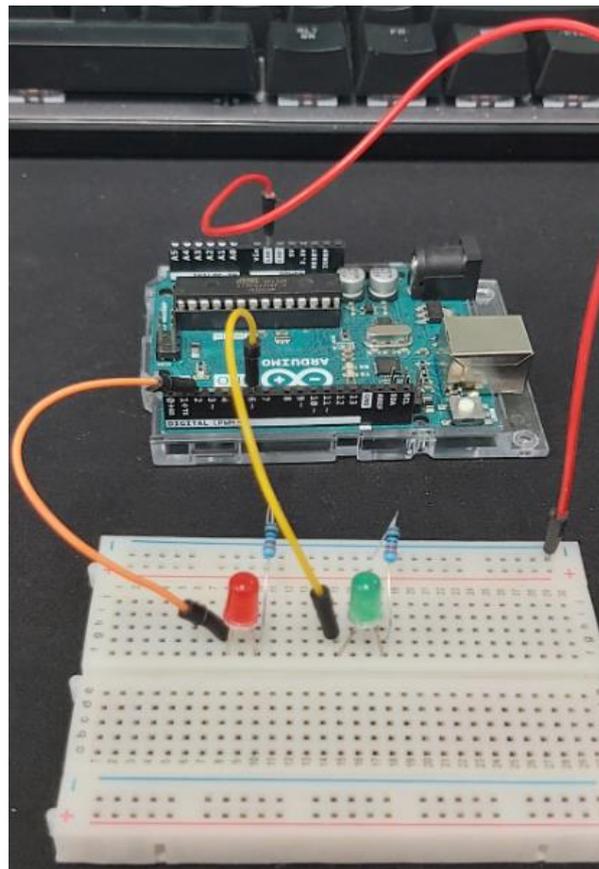
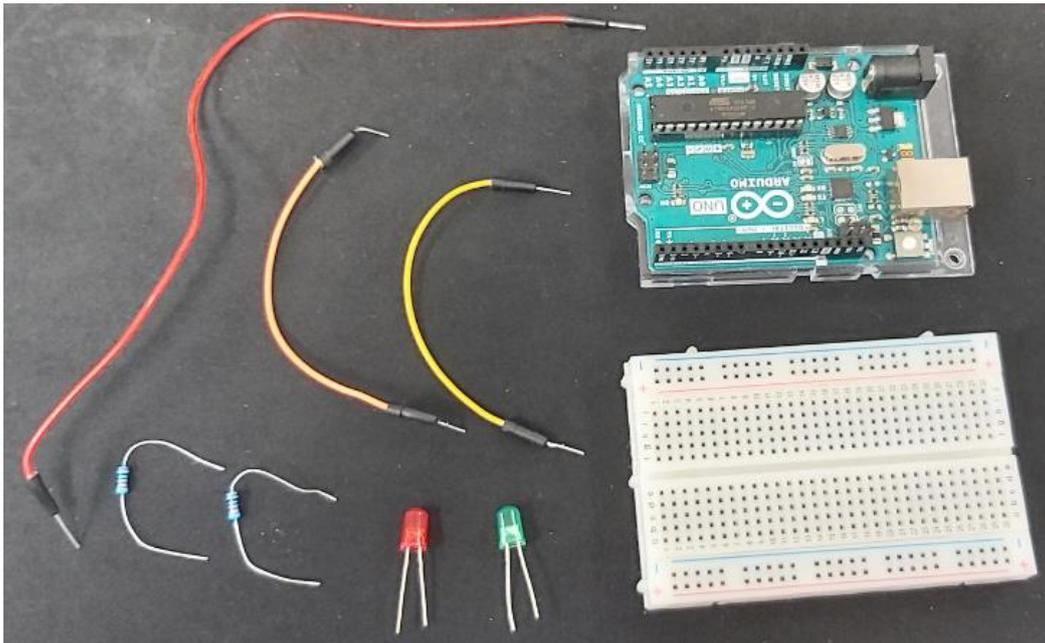


Erasmus+



InnoExperiment

INNOVATIVE APPROACH TO TEACHING THROUGH EXPERIMENT



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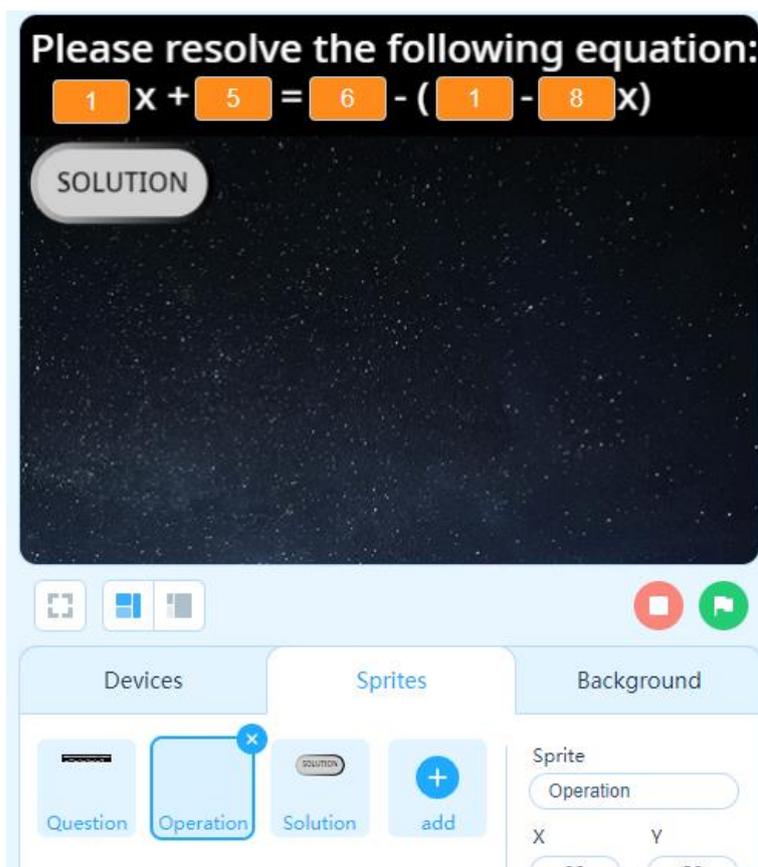
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ACTIVITY DESCRIPTION

For the development of the activity, we will use software that allows us to unify the game developed in Scratch with the use of the Arduino board. In this case, we have used the mBlock software: (<https://mblock.makeblock.com/en-us/>)

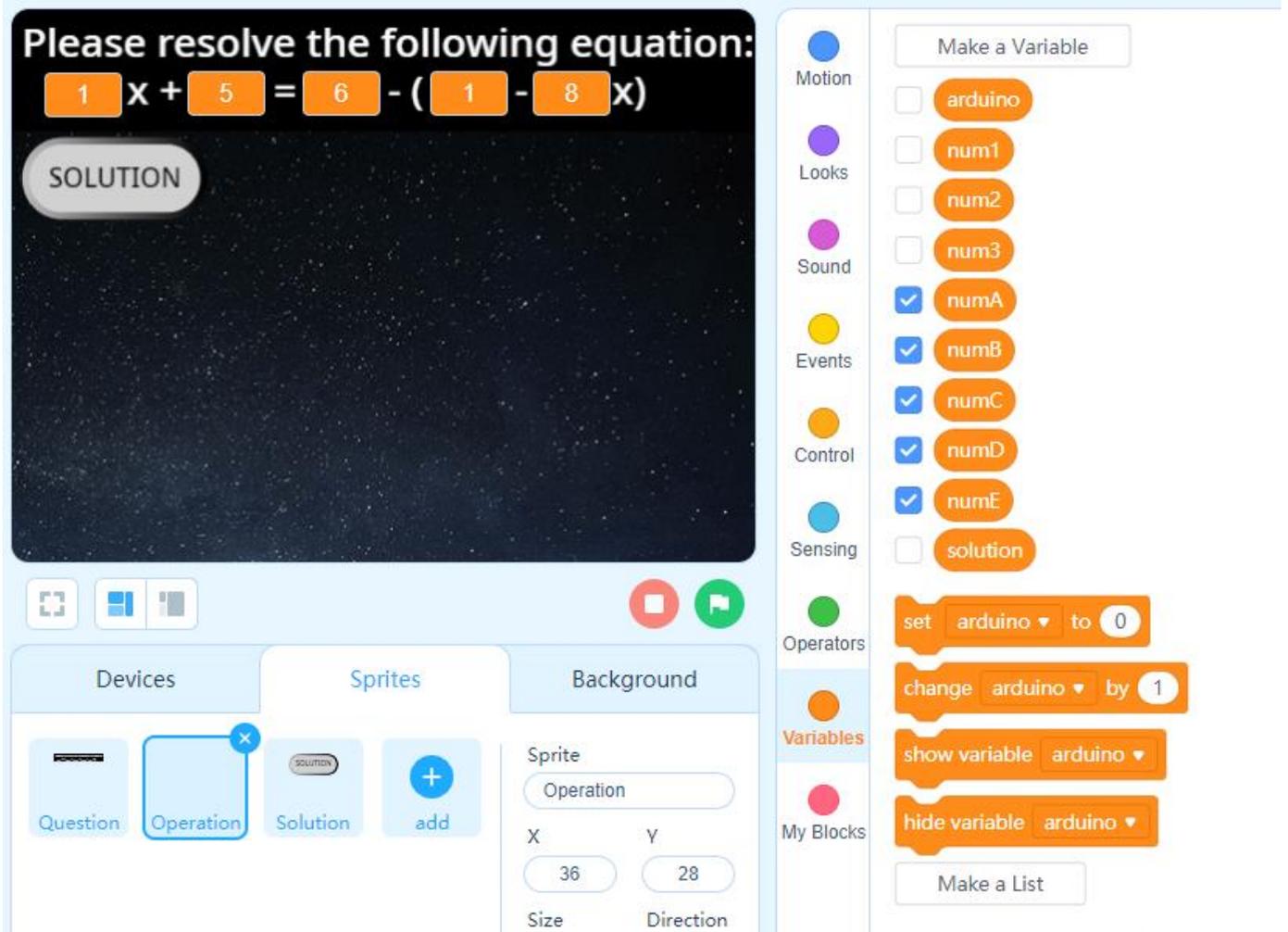
First of all, we will make the graphic composition of the activity:



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We will create as many variables as the equation has unknowns, in this case, we will use letters for the unknowns of the equation: "numA", "numB", "numC", "numD" and "numE", and for the grouping of preliminary calculations to solve the equation in variables with numbers: "num1", "num2" and "num3":



The screenshot shows the Scratch interface. The main stage displays the equation: $1x + 5 = 6 - (1 - 8x)$. Below the equation is a "SOLUTION" button. The right-hand side of the interface shows the "Variables" category with a list of variables: "arduino", "num1", "num2", "num3", "numA", "numB", "numC", "numD", "numE", and "solution". The "numA" through "numE" variables are checked. Below the list, there are four variable blocks: "set arduino to 0", "change arduino by 1", "show variable arduino", and "hide variable arduino". The bottom of the interface shows the "Sprites" area with a "Solution" sprite selected.

In addition, we will create the "Solution" variable, which will be the one that calculates the solution to the problem, and the "Arduino" variable, which will be in charge of sending to the Arduino board when and that the corresponding LED lights up.

Once we have the graphic composition and the variables created, we will start with the programming:

1. We will start by setting the visual background that we want to appear while the mathematical/physics problem is being posed and we will set the "Arduino" variable to 0, so that the LEDs are off. In addition, for the "numA", "numB", "numC", "numD" and "numE" variables, random values will be created, so that whenever the Activity starts, different values come out:

```

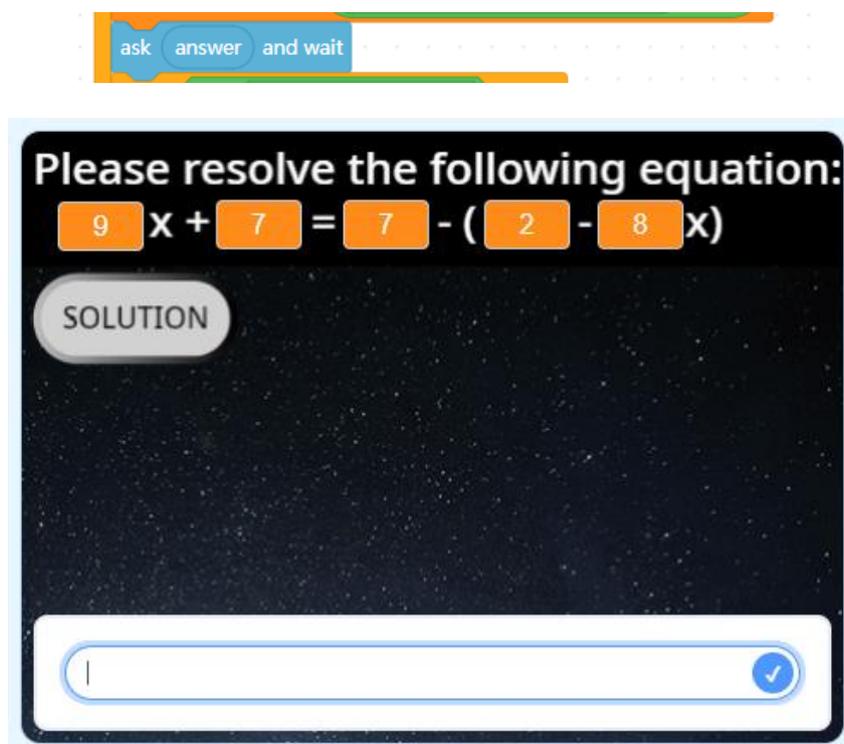
when clicked
  set arduino to 0
  switch backdrop to Stars
  forever
    hide variable solution
    set numA to pick random 1 to 9
    show variable numA
    set numB to pick random 1 to 9
    show variable numB
    set numC to pick random 1 to 9
    show variable numC
    set numD to pick random 1 to 9
    show variable numD
    set numE to pick random 1 to 9
    show variable numE
  
```

2. Then, we apply the formulas that will calculate the problem:

```

set num1 to numC - numD
if num1 < 0 then
  set num1 to abs of num1
  set num2 to numB + num1
else
  set num2 to numB - num1
set num3 to numA - numE
if num2 < 0 then
  set solution to num2 / num3
else
  set num2 to abs of num2
  set solution to num2 / num3
  
```

3. Next, the system wait for the user to write the result:



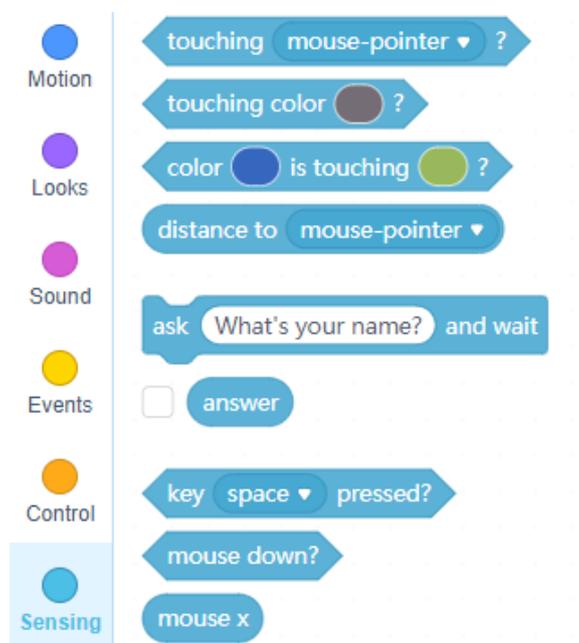
ask answer and wait

Please resolve the following equation:

$$9x + 7 = 7 - (2 - 8x)$$

SOLUTION

4. The result indicated by the user will be saved in a variable called “answer”, which will be created in the “Sensing” section:



● Motion

● Looks

● Sound

● Events

● Control

● Sensing

touching mouse-pointer ?

touching color ?

color is touching ?

distance to mouse-pointer

ask What's your name? and wait

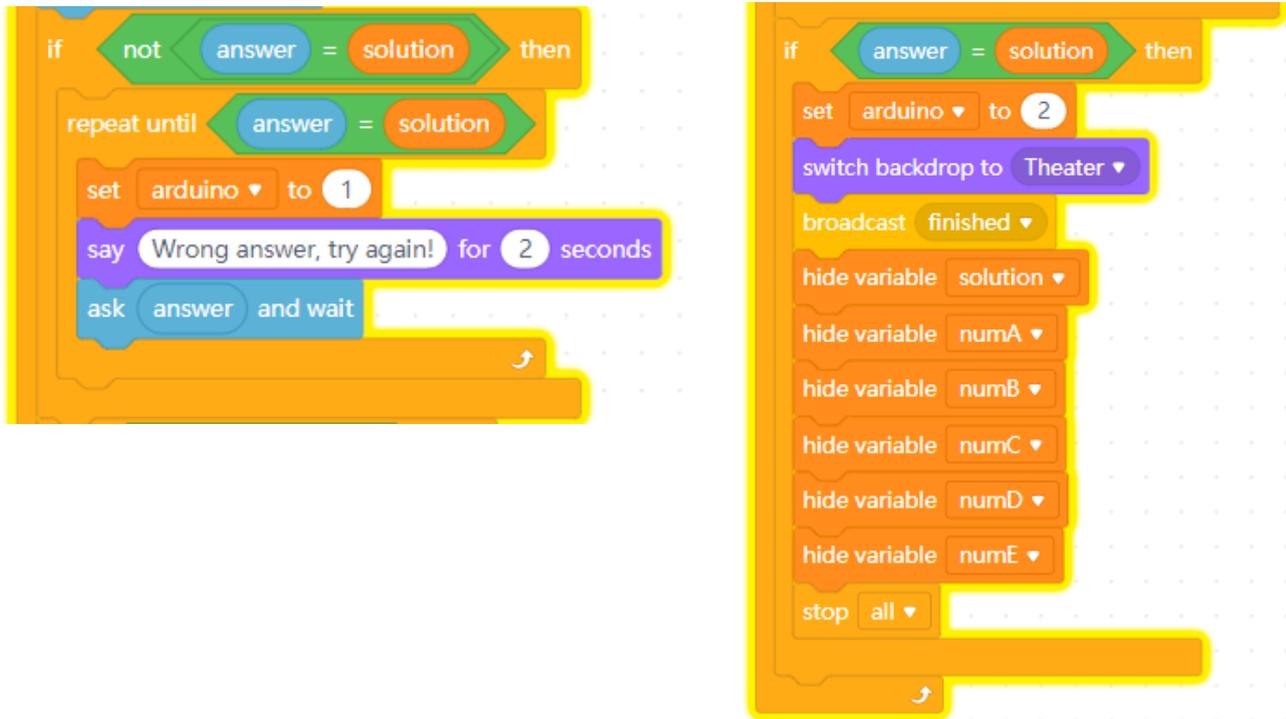
answer

key space pressed?

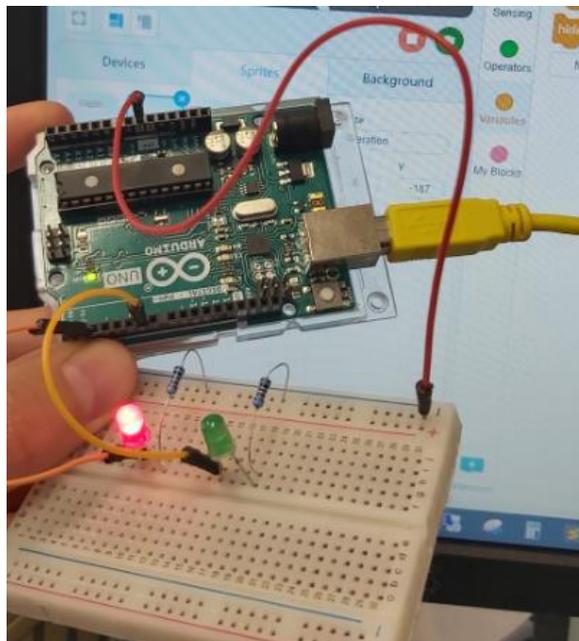
mouse down?

mouse x

5. Once the answer has been inserted, the programming will check to verify the result:

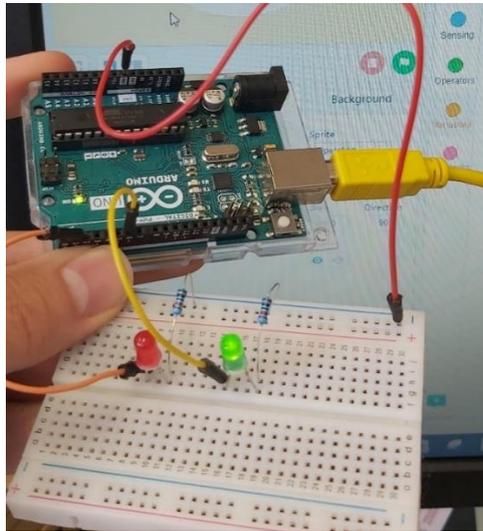


6. If the entered result is wrong, the game will display "Wrong answer, try again!" and will prompt the user to retype the answer. In this block the Red LED of the Arduino will light:



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7. If, on the contrary, the user types the correct answer, the Green LED will light up and the variables will be hidden and the background will change:



8. The main Code would be as follows:

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Please resolve the following equation:
 $2x + 3 = 8 - (7 - 3x)$

SOLUTION

Arduino IDE interface showing a Scratch-like environment with a question slide, a variable list, and a script area. The variable list includes: `arduino`, `num1`, `num2`, `num3`, `numA`, `numB`, `numC`, `numD`, `numE`, and `solution`. The script area contains the following code:

```

when clicked
  set arduino to 0
  switch backdrop to Stars
  forever
    hide variable solution
    set numA to pick random 1 to 9
    show variable numA
    set numB to pick random 1 to 9
    show variable numB
    set numC to pick random 1 to 9
    show variable numC
    set numD to pick random 1 to 9
    show variable numD
    set numE to pick random 1 to 9
    show variable numE
    set num1 to numC - numD
    if num1 < 0 then
      set num1 to abs of num1
      set num2 to numB + num1
    else
      set num2 to numB - num1
    set num3 to numA - numE
    if num2 < 0 then
      set solution to num2 / num3
    else
      set num2 to abs of num2
      set solution to num2 / num3
    ask answer and wait
    if not answer = solution then
      set arduino to 1
      say Wrong answer, try again! for 2 seconds
      ask answer and wait
  
```

Please resolve the following equation:
 $2x + 3 = 8 - (7 - 3x)$

SOLUTION

Arduino IDE interface showing a Scratch-like environment with a question slide, a variable list, and a script area. The variable list includes: `arduino`, `num1`, `num2`, `num3`, `numA`, `numB`, `numC`, `numD`, `numE`, and `solution`. The script area contains the following code:

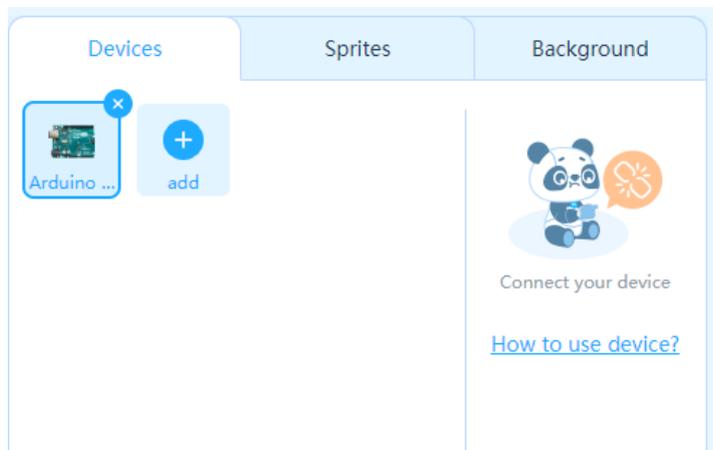
```

ask answer and wait
if not answer = solution then
  set arduino to 1
  say Wrong answer, try again! for 2 seconds
  ask answer and wait
if answer = solution then
  set arduino to 2
  switch backdrop to Theater
  broadcast finished
  hide variable solution
  hide variable numA
  hide variable numB
  hide variable numC
  hide variable numD
  hide variable numE
  stop all
  
```

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9. The code that would be in charge of lighting the LEDs on the Arduino board would be as follows:



```

when clicked
if  $arduino = 0$  then
  set digital pin 2 output as low
  set digital pin 6 output as low
if  $arduino = 1$  then
  set digital pin 2 output as high
  set digital pin 6 output as low
if  $arduino = 2$  then
  set digital pin 2 output as low
  set digital pin 6 output as high
  
```

STUDENTS' EVALUATION

The way to evaluate the students would be for them to demonstrate on paper how they have developed the exercise and to use the program / game to check the solutions.

SCALABILITY

Regarding the concept of scalability, the complexity could be increased by adding equations of the second or third degree