

Our first Computer Program
How do we communicate with a robot to make it understand us?

Summary

Date	xxx	Total duration	3 heures
Subject	Students will learn, without a computer, the concepts of an algorithm and a program. Using colors and shapes		
Year Group or Grade Level	5 years old		
Main topic	Students will learn why we need a computer program. They will learn how to write, interpret and analyze simple algorithms and programs. All this using the shapes and colors		
Subtopics or Key concepts	<ul style="list-style-type: none"> • What is an algorithm and what it is used for. Examples of algorithms • Why we need to develop a computer program 	<ul style="list-style-type: none"> • Express algorithms using symbolic language. 	

Learning Objectives

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| <ul style="list-style-type: none"> • What is an algorithm used for and how can it be applied to an everyday action • What is a computer program • The different between algorithm and program. | <ul style="list-style-type: none"> • The sequence of the instructions is important in an algorithm • There can be more than one valid solution to perform the same action |
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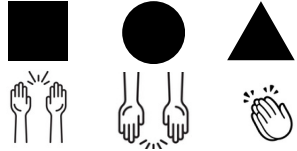
Material needed

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| <ul style="list-style-type: none"> • blackboard • pencils • Crayons of different colours | <ul style="list-style-type: none"> • chalks of different colors • sheet of paper • the worksheet attached to this lesson (one copy for each group) |
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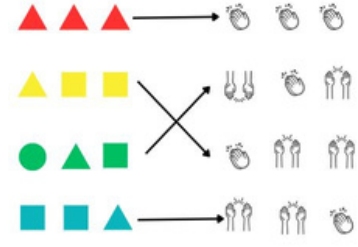
Lesson Outline

	Duration	Guide	Remarks
warm-up	15 minutes	<p>We begin the activity by describing the actions we take every day.</p> <p>The idea is that the students can detect actions and decisions needed to complete one routine.</p>	<p>For example, the teacher can ask about the daily routine of brushing teeth (or other). "Do you brush your teeth? Why is it necessary to brush your teeth? What do you do when you brush your teeth?".</p>
	15-20 minutes	<p>Generate a discussion for students to exchange ideas on the chosen topic and decide the steps needed to carry out the selected action.</p> <p>We guide the students to define the instructions and we draw them on the blackboard.</p>	<p>If different alternatives appears, we draw them separately to be analyzed.</p> <p>There can be different alternatives to achieve the same solution.</p> <p>We emphasize that the order of the instructions is important.</p>
	15-20 minutes	<p>Check that the listed tasks are correct. Explain to students that what they have just done is "design an <u>Algorithm</u>" (which is an ordered list of steps to accomplish an objective").</p>	<p>Students can mime the instructions drawn on the blackboard.</p> <p>To invite students to use their own words to describe what an algorithm is.</p>
	10 minutes	<p>Review colors and shapes to be used in the next activity.</p>	
main activity	10 minutes	<p>Review the concept of algorithm and what it is used for. Stress that there can be several valid algorithms to obtain the same solution. The order of the instructions is important.</p>	<p>The teacher can repeat the previous exercise with a different activity to fix the concepts.</p>

Lesson Outline

	Duration	Guide	Remarks
main activity	10 minutes	<p>Main Discussion:</p> <p>Sometimes, we need to write an algorithm, which can be executed by a machine or robot. But robots are not able to understand the human's languages (natural languages, such as English or Spanish). The algorithms we design for robots consist of a finite and fixed set of instructions that the machine can carry out. Algorithms written in this way are called Programs.</p>	<p>It is recommended to reinforce the Algorithm vs. Program concept with several examples:</p> <ul style="list-style-type: none"> - You can use the algorithm designed in the previous activity to explain that a robot does not understand the instruction "pick up the toothbrush to brush your teeth". - When we want the robot vacuum cleaner to clean the house we cannot say "robot clean the kitchen". We need to give them more concise commands
	15 minutes	<p>Guided Activities:</p> <ol style="list-style-type: none"> 1. Explain that we are going to become dancing robots. Using three geometric shapes to code dance steps: a triangle will indicate that we should clap our hands, a square that we should raise both hands, and a circle that we should extend both arms downward. 2. Divide the class into groups of 3-4 people. Assign a color to each group 	 <ul style="list-style-type: none"> - This dance code is a proposal. - Background music can be played

Lesson Outline

	Duration	Guide	Remarks
main activity	15-20 minutes	<p>3. Draw some sequences on the board (a combination of colors and symbols) and help the class (robots) to perform the corresponding dance. Repeat this exercise as many times as necessary so that the students are clear about the program.</p>	<p>For example, we could draw  and, meaning that the "red team" should extend their arms downward, then the "blue team" clap their hands twice, then the "yellow team" clap their hands twice, and finally the "red team" extend their arms upward.</p>
	15-20 minutes	<p>4. Hand out worksheet 1, to solved by teams. They have to join with arrows the four sequences of figures with their corresponding dance (each group with its color).</p>	<p>The solution for the exercise is (the color depends on each group):</p> 
	15 minutes	<p>5. After completing the worksheet we share it with the class for correction.</p>	<p>If some groups have not solved the tasks correctly, we analyze their answers together to identify the errors and solves them.</p>

Lesson Outline

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main activity	30 minutes	<p>6. Each group must define one choreography (involving all "groups of robots") and draw it on a sheet of paper using the language of figures.</p> <p>7. Once the choreographies are designed, they are written one by one on the blackboard. The whole class must perform each choreography following the steps described by the figures.</p>	<p>Try to have at least one symbol of the color of each group in each choreography. So that all groups will have a step to dance.</p>
	10 minutes	<p>8. Ask the question "What differences do you find between how we talked with our friends and the dancing robots?".</p>	<p>We guide the discussion to conclude that in this activity the robots (students) have not been able to use natural language (raising arms, giving a palm, etc.) . They have had to use only three different colored geometric forms</p>
	10-15 minutes	<p>9. Explain to students that we cannot use the same language to communicate with people as we use to communicate with a robot. Robots do not understand natural language such as "clap your hands" or "raise your arms". To communicate with machines/robots we need to use a special language (in our case colored geometric shapes) which are called <u>Programs</u>.</p>	<p>In this case, the students acted as robots executing (choreographing) <u>a program</u> (colored geometric shapes).</p>

Lesson Outline

	Duration	Guide	Remarks
assessment	30 minutes	<p><u>Assessment or Evaluation</u></p> <p>The objective of this lesson is to introduce students the concept of algorithm and program. What they are used for and the difference between them.</p>	<ul style="list-style-type: none">• Students should be able to use an algorithm to perform an everyday action.• Express algorithms using symbolic language (Program)• Students has to work in a cooperative way to solve the challenge posed.

Assessment exercise

This assessment exercise can be carried out in groups, taking into account that all members must participate.

Concept of Algorithm and its characteristics:

- They should be able to express in their own words what an algorithm is and develop an example.
- They should know that the order of the instructions is important. The teacher can change the order of some instructions on the example proposed by the students and ask the questions: "What happens if I change the order of these two instructions? Can I perform the action correctly with this change?, Why?"
- Sometimes there is no single solution to perform the same action. The teacher can propose alternative examples to the students to perform the same action as they already proposed. Ask the students: Is my algorithm valid also to perform the proposed action? Why?

Concept of Program and its characteristics:

- The students should be able to express in their own words why we need a computer program for. For this purpose, the teacher can ask "Can we use the above algorithm to communicate with a robot? why not? What kind of algorithm do we have to use to communicate with robots?."
- The students have used the symbolic language to write a "program". Each participant has actively and positively collaborated in the realization of the Worksheet and in the coding of dance

Different between algorithm and Program:

- The students has to know when we need an algorithm and when need a program. The teacher can ask the questions: What does my partner have to use if he wants to teach me how to draw a house? an algorithm or a program? and if we want to communicate with a machine?

Conclusions and recommendations

- The idea of this lesson is to introduce students to the concept of programming through a familiar topic such as geometric shapes and colors.
- The lesson can be extended by repeating the previous exercises and introducing more complex tasks. For example by introducing more geometric shapes associated with new dance steps.

Worksheet 1



Link each sequence of figures with the corresponding dance steps.

