

Programming-
Online programming


## Summary:

This activity introduces the concept of algorithms as well as the initial steps to programming with Scratch. More specifically, this exercise comprises five sequenced activities that help students to understand the basic functions of programming as well as providing the basics of how to get started programming with Scratch or another programming language.

Target group: students from 7 years or older with basic literacy and numeracy skills
Duration: 120 minutes

## Learning goals:

- Understand, interpret, and design algorithms
- Define the instructions of a program using pseudocode
- Go from pseudocode to Scratch code.
- Write programs of medium-level complexity

Online/offline: offline

## Computational Thinking:

- General skills: teamwork, creativity, algorithm thinking, logical thinking.
- CT foundations: Algorithm, Pattern Recognition
- CT concepts:
- Basic programming structures
- Sequential
- Iterative (repetition, loops)
- Conditional (selection)
- Nested structures
- Procedures
- Functions
- Coordination \& synchronization


## Materials:

- Blackboard, pencils, paper, and erasers
- Printed worksheets (1-4) for each student
- When possible: access to a computer with an internet connection


## Programming for beginners

Preparation: print worksheets 1-4 for each student

## Introduction ( 5 min ):

Below you will find a set of five sequenced activities that will help students to understand the basic functions of programming as well as providing the basics for getting started with programming using Scratch or another programming language.
The activities are designed to increase in complexity as they go and culminate with a final activity at a more advanced level that requires a minimum knowledge of Scratch concerning costume changes, character and object animation and chained actions.

Description of the lesson (120 min):
CHALLENGE 1 - DRAWING A SQUARE

Suggest that students describe the steps needed to draw a square on the board. To do this, ask a student to say out loud the commands they would give to another student to draw a square on the board/paper. The other student should not know what they are drawing. Later on, you can also try to get a student to draw a more complex figure than a square.

Some reflection questions that can be asked to the students:

- How did it go?
- Is the information complete?
- Are the commands accurate?
- What commands did we miss?
- How could we improve our commands?

The students should then be given a set of unordered instructions (worksheet 1), which they then have to put into the correct order to be able to draw the square on the board/paper.

Set of unordered instructions:

- Draw a straight line to the right of 20 cm long.
- Put the painting on the blackboard.
- Turn 90 degrees to the right.
- Draw a straight line to the right of 20 cm long.
- Draw a 20 cm long straight line to the right.
- Turn 90 degrees to the right.
- Draw a straight line to the right 20 cm long.
- Stand in the centre of the board.
- Pick up a brush/pencil.
- Turn 90 degrees to the right.

Check the correct order of the instructions with the students afterwards．See appendix 3 for the solution of the activities．

After they have identified the correct sequence，ask the students to look at the list of instructions．Next， ask them the following questions：Have you noticed that there are repeated sets of instructions？Can you identify which set of instructions are repeated and how many times？How could we explain the same instructions，but using fewer sentences to do so？

Possible solution：
－Take a painting．
－Stand in the centre of the board．
－Rest the painting on the board．
－Draw a straight line to the right of 20 cm long．
－Repeat 4 times：
o Draw a straight line to the right of 20 cm long．
o Turn 90 degrees to the right．

Through this activity，students how important it is to give instructions in the right order，in a precise way and even how to make more efficient program by using repetitions or loops．


## CHALLENGE 2 - DRAWING A SQUARE USING SCRATCH

Hand out worksheet 2 to the students. Ask the students to make the same square but using Scratch programming blocks. This activity can be carried out either online or offline. In the offline mode, students only have to draw the codes in an orderly fashion. An unplugged mode of the activity can also be offered by cutting out the blocks so that they can group them in the correct way.


This exercise students transfer learn o the previous activity and identify the same instructions in the programming blocks. the may no experience with Scratch,students are provided with the blocks to use.

## CHALLENGE 3 - DIFFERENT SHAPES

The next step in helping students to create programs with the Scratch language is to provide them with exercises in which they have to understand the action that a program will perform.

Hand out worksheet 3. Ask the students to associate a program similar to drawing a square with other shapes, such as a circle, triangle, or rhombus. To do this, students have to apply what they have learned in the previous exercises and correctly interpret the repetitions or loops and the angles of rotation.


## CHALLENGE 4 - HELP THE ASTRONAUT TO ACCOMPLISH THE MISSION

Now that they have been introduced to the Scratch programming language, students can now transfer what they have learned to another similar programming language, namely Blockly in the KODETU environment.

In the following challenges the student must help the astronaut to accomplish their mission. Tell the students to arrange the blocks in order to give the astronaut the correct instructions to reach the goal (red dot). To do this, they can only use the blocks that appear.
They can also do this activity online (http://kodetu.org/).



ADVANCED ACTIVITY - CREATE YOUR OWN INTERACTIVE ANIMATION!

After having learned how to design their first programs in Scratch and KODETU, provide the students with a free creative activity in which they will have to program. Ask the students to create an animation about themselves. They need to combine images and sounds to create an interactive collage. Encourage the students to experiment with characters, costumes, backgrounds, appearance blocks and sounds to create an interactive project with Scratch.

Give the following initial instructions to the students:

- Create a character.
- Make it interactive.
- Make your character interactive by adding programs that make the character respond to clicks, key presses, and other things.
- Use costumes to change the character's appearance.
- Character's appearance.
- Create different backgrounds.
- Try adding sounds to your project.
- Try adding movement to your collage.


## Conclusion (10 min):

Propose to the students that they share the programs and animations they have designed.

In this activity, students analyse the behaviour of other programs, identify errors, improvement, etc. In programming, we learn by analysing other programs, so it is important that students analyse both the program and the behaviour of classmates' animations.


Appendices

## Appendix 1: worksheet - challenge 1

Put the following instructions for drawing a square into the correct order:Draw a straight line to the right of 20 cm long.Put the painting on the blackboard.


Turn 90 degrees to the right.Draw a straight line to the right of 20 cm long.
$\square$ Draw a 20 cm long straight line to the right.


Turn 90 degrees to the right.Draw a straight line to the right of 20 cm long.Stand in the centre of the board.Pick up a brush/pencil.
$\square$ Turn 90 degrees to the right.


## Worksheet - challenge 2

Can you write the code to draw a square with Scratch using the following blocks?
You can either do it offline using the blocks below or online here: https://scratch.mit.edu/.

## turn $C^{*} 90$ degrees <br> pen down


go to $x: 0$ y: 0

move
150
steps


## Worksheet - challenge 3

Try to identify each code sequence by the image it draws:


## Worksheet - challenge 4

Help the astronaut to accomplish their mission.
In the following challenges you are going to help the astronaut to accomplish their mission.
Go to the following website: http://kodetu.org/
Collect the blocks to give the correct instructions to the astronaut to help them reach their goal (red point). You are only allowed to use the blocks that appear on the screen.


Mission1 - Your answer:


Mission 2 －Your answer：
$\square$

Appendix 3：solutions to the challenges

## CHALLENGE 1

## Correct order of instructions：

－Pick up a painting．
－Stand in the centre of the board．
－Rest the painting on the board．
－Draw a straight line to the right 20 cm long．
－Turn 90 degrees to the right．
－Draw a straight line to the right of 20 cm long．
－Turn 90 degrees to the right．
－Draw a straight line to the right of 20 cm long．
－Turn 90 degrees to the right．

## CHALLENGE 2

Mission 1：
move forward
move forward

## Mission 2：

move forward
move forward
turn right $\circlearrowright$
move forward

## CHALLENGE 3





## Colophon

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