Year F-2 & 5/6 - Cross Age Making a Robot

## Learning Focus

This lesson sequence is a cross-age project that can be used for students in year 5/6 in collaboration with students from years F-2. In this project, students collaborate on a code for an unplugged robot. They design, test and modify the robot and create instruction manuals.

## Curriculum Links:

**Digital Technologies Year F-2**

**Strand**: Digital Technologies Processes and Production Skills

**Content Description:** Follow and describe algorithms involving a sequence of steps, branching (decisions) and iteration (repetition) [(AC9TDI2P02)](https://v9.australiancurriculum.edu.au/f-10-curriculum.html/learning-areas/digital-technologies/year-1_year-2/content-description?subject-identifier=TECTDIY12&content-description-code=AC9TDI2P02&detailed-content-descriptions=0&hide-ccp=0&hide-gc=0&side-by-side=1&strands-start-index=0&subjects-start-index=0&view=quick).

**Strand**: Design Technologies Processes and Production Skills

**Content Description:** Generate and communicate design ideas through describing, drawing or modelling, including using digital tools [(AC9TDE2P01)](https://v9.australiancurriculum.edu.au/f-10-curriculum.html/learning-areas/design-and-technologies/year-1_year-2/content-description?subject-identifier=TECTDEY12&content-description-code=AC9TDE2P01&detailed-content-descriptions=0&hide-ccp=0&hide-gc=0&side-by-side=1&strands-start-index=0&subjects-start-index=0&view=quick).

**Digital Technologies Year 5-6**

**Strand**: Digital Technologies Processes and Production Skills

**Content Description:** Design, modify and follow simple algorithms involving sequences of steps, branching, and iteration (repetition) (ACTDIP019)

**Strand**: Digital Technologies Processes and Production Skills

**Content Description:** Design algorithms involving multiple alternatives (branching) and iteration [(AC9TDI6P02)](https://v9.australiancurriculum.edu.au/f-10-curriculum.html/learning-areas/digital-technologies/year-5_year-6/content-description?subject-identifier=TECTDIY56&content-description-code=AC9TDI6P02&detailed-content-descriptions=0&hide-ccp=0&hide-gc=0&side-by-side=1&strands-start-index=0&subjects-start-index=0&view=quick).

**Strand**: Design Technologies Processes and Production Skills

**Content Description:** Implement algorithms as visual programs involving control structures, variables and input [(AC9TDI6P05)](https://v9.australiancurriculum.edu.au/f-10-curriculum.html/learning-areas/digital-technologies/year-5_year-6/content-description?subject-identifier=TECTDIY56&content-description-code=AC9TDI6P05&detailed-content-descriptions=0&hide-ccp=0&hide-gc=0&side-by-side=1&strands-start-index=0&subjects-start-index=0&view=quick).

**Strand**: Design Technologies Processes and Production Skills

**Content Description:** Generate, iterate and communicate design ideas, decisions and processes using technical terms and graphical representation techniques, including using digital tools [(AC9TDE6P02)](https://v9.australiancurriculum.edu.au/f-10-curriculum.html/learning-areas/design-and-technologies/year-5_year-6/content-description?subject-identifier=TECTDEY56&content-description-code=AC9TDE6P02&detailed-content-descriptions=0&hide-ccp=0&hide-gc=0&side-by-side=1&strands-start-index=0&subjects-start-index=0&view=quick).

## Learning Hook

Ask the students what different things they think or know about robots. There will be a wide range of answers from both F-2 and 5/6 students but this will give a number of ideas to start with. Encourage them to think about the jobs that robots do, what they look like and how they work.

Explain to students that they are going to work together in collaborative teams to build a human robot. The instructions will be passed on to a human who is wearing a robot costume.

Watch part or all of the [show about robots](http://splash.abc.net.au/home#!/livestream/1303065/robots-). As the students are watching, discuss the types of robots they are seeing, how they are working and what they look like.

Finally collect and look a variety of images of different types of robots. Discuss how the robots look, colours that are used and the materials they use to make them. Look carefully at the shapes used to make these robots. Why do they think robots are used making these shapes?

Explain to students when they make a robot that the messages are the code that will be entered to the robot. The human robot hears the code and then responds with the action.

## Learning map and outcomes

Explain to students they will make a robot costume for a year 5/6 students to wear and program that robot to move around the school and perform certain tricks or functions. They will also create a manual so other people can use the robot. The F-2 students will focus on the design of the robot and giving instructions, while the year 5/6 students will focus on recording recipes as algorithms and creating a user manual. The teams of F-2 students and 5/6 students (approximately 4) will work collaboratively.

Tell students they will:

* Design and construct a robot costume to fit a year 5/6 student.
* Develop a code for programming the robot.
* Create an instruction manual for the robot.
* Design recipes for other people to use the robot.

## Learning Input

Explain to students that in order for a robot to move it needs instructions to follow. An input is the instructions and steps we want the robot to do and then the robot outputs that instruction.

Give students time to explore different robots you may have such as beebots, dash and dot, ozobots, spheros (you may choose to watch videos of these robots in action if you do not have access to them).

After students have had enough time to explore these robots, come together to discuss the following questions.

What do they have in common?

How do they know what to do?

What functions do they have?

How do you input information into the robot?

Explain that the year 5/6 students will be developing a code to represent the functions the F-2 students choose for the robot to make. Discuss what the robot might be able to do (examples could include walking, running, turning, jumping, making noises).

Give students time to explore the robots again, this time focussing on the functions they can do. Make a list of the different functions the robots do (E.g. left, right, forward and backwards, stop, make sound). Discuss the symbols or inputs used to tell the robot what to do (E.g. arrows, colours, shapes).

Students return to their cross age groups and list the different functions they want the robot to do, considering some of the movements they have seen in the shared robots.

**What is code - Year 5/6 students**

You may choose to complete this more complex part of the sequence with only 5/6 students although through adaption of language it could be facilitated with both F-2 and Year 5/6 students.

Show students some different types of code such as drag and drop Scratch code, symbols, words or a specific language such as python or java. Explain these are different ways we can represent the inputs, outputs and functions of instructions for our robots. Code is a set of symbols or words to represent the different functions.

Make a list of what they notice about the different types of code and discuss how this code is used. Point out to students that once set, the code is always used the same way and if you alter this code, the code will not be recognised (and robot will not work).

Each of the different parts of a code can be put in a sequence to create an algorithm. An algorithm is the set of steps used to solve a problem. E.g. Getting the robot from one side of the playground to another is the problem and the inputs you will need to put into the robot will be the algorithm. It is similar to a recipe and the steps taken to create it.

The 5/6 students’ role throughout this project will be to create a coding language that can be used by the F-2 students to control the robot and follow instructions. Their first step will be to decide on words or symbols to represent the inputs and functions. They will have an opportunity to test their robots with the F-2 students to check their code is appropriate.

Explain to the Year 5/6 students that their role in the collaborative groups is to help make the F-2 students successful. They will need to support their understanding by explaining how the robots work and describe what is happening as they go.

## Learning Construction:

1. **Design**

Students work in collaborative groups to talk about what their robots will look like. Students choose one idea to further develop into a detailed design. Students draw and label the features of the robot such as arms, head and any moving parts they may have. Students may start to show how they will code the robot and how the instructions may be inputted into the robot (such as buttons or arrows to show voice activation). They discuss what the main function of the robot will be.

2. **Build**

Students start by measuring the year 5/6 student who will wear the robot costume and add these measurements to the design. Discussions with the teams will revolve around ensuring the robot costume will fit the human and gathering data to ensure the robot will suit. Provide students with a variety of materials they may use and encourage discussions in teams to consider which materials will be the most appropriate. Teachers should ensure there is an opportunity to test the size of the robot as they are building it and iterating as needed.

3. **Code**

Students discuss in their teams the different types of movements they would like their robot to do. During this time encourage students to consider the functions of the robots they used in the input lesson as inspiration for their movements. Students will need to remember to make the functions suitable for the human robot to perform. They will also need to remember the different types of functions so the list shouldn’t be too extensive. As students are considering the different functions the human robot should test these out as sequences and individual functions to ensure they will be suitable.

4. **Sequence and Test**

At this point, students will put together sequences of the functions for the robot and test these out. F-2 students may use symbols or characters with the support of the year 5/6 students to record the sequences they will give the human robot. The role of the 5/6 students is to identify where there may be issues with the code. E.g. are they giving specific numbers to say how far left or right, are they running into walls, or if they get too far from the F-2 students and can they hear directions? They should give feedback to the F-2 students as they are testing the sequences. At this point they may make changes to the code to make it more user friendly.

5. **Create algorithms**

Using the code that has been created, the teams work collaboratively to design different recipes for the robots. Explain to students that algorithms are the steps they will sequence together to get the robot to do something. Students can design and record 3-5 algorithms they can add to the instruction manual for people to use as ideas.

6. **Instruction manuals**

Now the robot has been completed, it will require a manual so that other people can use the robot. This will be predominately completed by the year 5/6 students and hosted using an online system such as a website, app maker or Scratch. The F-2 students draw some of the images that can be scanned or photographed and used in the instruction menu and the home page of the robot manual. This will be their contribution to the instruction manual. As the year 5/6 students plan their instruction manual, they may ask the F-2 students to provide further drawings and diagrams.

Year 5/6 students start by investigating and exploring different instruction manuals. They may bring some of these in from home, use instructions for the robots explored in the input lesson or search for them using a search engine on the Internet. Look specifically at the different types of user manuals and the features of them, pointing out different language devices used such as diagrams, verb and adverb use, time connectives, labels, captions or flow charts. Model how to write an instruction manual with subheadings and diagrams.

The instruction manual will need to include

* A labelled diagram of the robot for the manual
* Clear instructions
* Show the different recipes or algorithms and how to program the robot.

## Learning Demo

As a last step to the project, teams will swap their human robots between groups to test and offer feedback. They should consider how easy it is to follow instructions, if it made sense, any problems and what was successful.

In groups students can share their human robot and give a demonstration of how it works and an example of one of the algorithms. During this time, the teacher can ask questions to assess students’ understanding.

## Learning Reflection

Ask students to reflect in their groups. Give students time to talk about what they liked in doing the project and what it was like to work in a team. Ask students to complete a self-reflection (attached). F-2 students can draw or write what they like about the robot (its features), what they wonder (questions they still have) and what they could do next with their learning.

Year 5/6 students complete a similar reflection, writing what they learnt about robots and code and determining their next steps for learning.

## Assessment

F-2 Checklist

|  |  |  |
| --- | --- | --- |
|  | With Support | Independently |
| Understand that data is transferred from the human to the robot |  |  |
| Interacts with different digital toys and experiments with their functions |  |  |
| Understands the robot as a model of an imaginary digital system |  |  |
| Explains the features of the design of the robot |  |  |
| Provides instructions to the robot to move in an intended manner |  |  |
| Describes the steps involved in a process |  |  |
| Gives instructions in a sequence |  |  |
| Considers how to keep the human robot safe |  |  |
| Discusses how robots might be used in our lives |  |  |
| Creates an image understanding it will be seen online |  |  |

5-6 Checklist

|  |  |  |
| --- | --- | --- |
|  | With Support | Independently |
| Explains the robot as a digital system and having internal and external components that perform different functions |  |  |
| Explains how the data is transmitted between the F-2 student and the robot |  |  |
| Recognises that algorithms can be represented by using codes |  |  |
| Uses knowledge from explored robots and features that are transferable to their robots |  |  |
| Understands the robot front is a user interface |  |  |
| Considers how the user can input data irrespective of language background |  |  |
| Creates a design with labels and captions |  |  |
| Follows a diagram of instructions |  |  |
| Creates a flow chart or diagram with clearly defined decisions, processes, inputs and outputs |  |  |
| Designs the instructions for the robot |  |  |
| Designs and creates an algorithm which is interactive |  |  |
| Uses language such as ‘if’ and ‘then’ to explain how the robot works |  |  |
| Explains how people will interact with the robot easily |  |  |
| Considers the knowledge of team members when making decisions |  |  |
| Works collaboratively to design and build a website |  |  |

## Resources