This page is for

Teachers | Parents and carers

Digital Technologies @ Home
Unplugged activities for students

This activity is for: Years 3-4

Flat Pack LEGO

LEGO is a trademark of the LEGO Group

This activity teaches...

This activity teaches an introduction to Algorithms using LEGO construction bricks. The students will be required to represent different blocks using only words (Data representation) and deliver explicit instructions (algorithms) to another student to help them to build a LEGO figure.

It is targeted towards primary students and is expected to take between 30 minutes and 1 hour. Print page 2 for your student and page 4+ for yourself.

You will need...

LEGO
Pen and paper

See a demonstration

cmp.ac/legovid

Getting started (read this with your child):

When you buy "flat pack furniture", it comes as parts in a box with instructions to help you build it correctly. You might have helped to build some! We're going to make a LEGO creation and see if we can write the best instructions possible to help someone else build it without you there to help them. Just like a flat pack LEGO creation!

Step by step

Give the student 10-15 minutes to create something from LEGO using 10 pieces or less. Encourage simplicity: it doesn't have to be amazing, it just has to contain 10 pieces. The student should keep their final product a secret so they can accurately test their instructions.

Once built, give them another 10 or so minutes to write instructions that someone will need in order to replicate their creation. The instructions should include the name of what they are building in the title, for example "a washing machine", "my friend Kelly", "an alligator".

Once the instructions are written, the student gives the instructions and the LEGO pieces to someone else, ideally in exchange for the other person's pieces and instructions. Give the students 10 minutes to try and build each others' creations. (We recommend 10 minutes as 5 is often too short but 15 can make a frustrating creation become discouraging.)

After the time is up, come together and see how you did. Discussions will naturally start about what worked and what didn't. Try and guide them to what improvements they can make to their block names and directional instructions. After a few repeats consider integrating diagram or photographic instructions. They will likely increase the success rate and lower the time taken to build.

This page is for Students

Flat Pack LEGO

Help someone else to recreate your LEGO creations by writing the best instructions possible!

LEGO is a trademark of the LEGO group

Step 1

Build a LEGO creation in 10 pieces or less. It can be an animal, a person or an object.
Whatever you can build in 10 pieces is great! Keep the finished creation a secret for now.

Step 2

Once you have designed and built your creation, write instructions on how to build it.
They can be as long or as short as you like, but try to make them as clear and easy to follow as possible.

Step 3

Break your creation back into pieces. Now, give the pieces and your instructions to someone and see if they can build your creation. They might give you instructions and LEGO to build too, follow their instructions carefully.

Step 4

When they are finished or time is up, check and see. How did they do? Did they make exactly the same thing?
If they didn't, talk to them about what was confusing in your instructions, how can you make them clearer?

Step 5

Rewrite your instructions until the builder makes it perfectly. If the builder already knows how to build it, you might have to come up with a new creation for them. What else can you add to your instructions to make it easier to understand?

Answer key

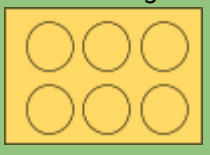
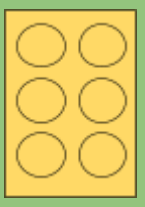
Choose if you want to print this for your kids or keep it to yourself!

Parents and carers

The ideal instructions
The overall solution to this activity are instructions that provide enough information for the builder so that they can successfully build your creation. The instructions can take many forms but they key factors are:

- Clear definitions
- Clear context

Let's unpack those a bit more.

Clear definitions	Clear context
Ideal instructions will define a few things before you get started. You need to make sure that the builder knows without a doubt which blocks are which, or they're going to build off the plan. You should also define your rotations, this is important for terms like "left, right top" etc. Should left mean 30 degrees left? 90 degrees? Starting from where? This brings us to the second major part, context.	The position of the pieces needs to be contextualised so that you know what edge is the left, the top etc. Consider a block that is 2x3 circles big. Which is the left hand edge?  This is the same block, which is the left hand edge now?  It all depends on the context which you can give your builder by having a chat beforehand, or by including extra details about how to place pieces when they are setting up to build.

There's no official LEGO terminology for parts (aside from their part numbers) so it's completely up to you! Just make sure that you give the names clear context and definition.

Diagrammatic or Photographic Instructions
Visual instructions can be just as good, if not better. But why?

If your student has struggled to contextualise spatial instructions (e.g. 'up, down, the top, turn left, rotate upward'), they're not alone! It's really hard to define all the spatial aspects necessary for clear 3D instruction.

A photo or diagram has a lot of this information implicitly* present. The spatial position of the block is already communicated so instructions to "flip it over" can be taken in the content of that image and interpreted more easily.

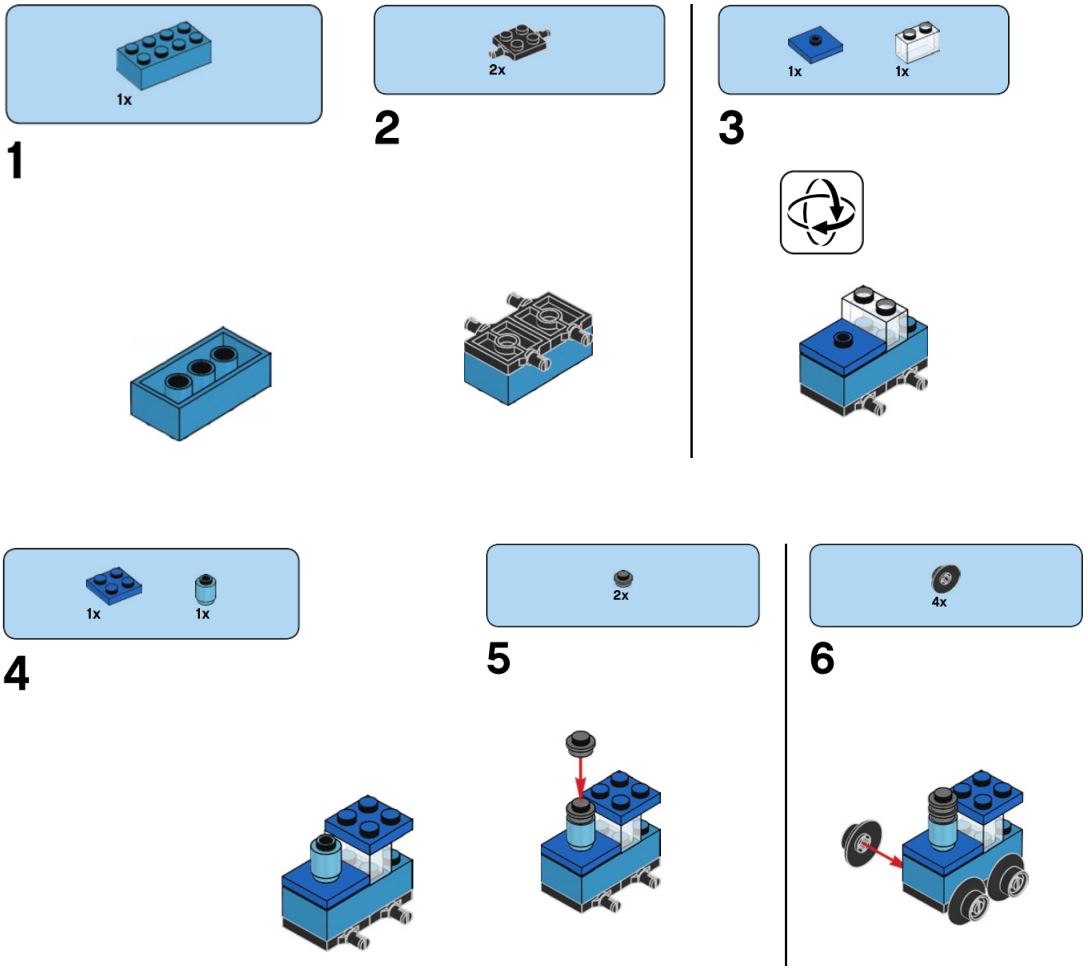
*implicitly: in a way that is suggested but not communicated directly (Cambridge Dictionary)

This is why so many building instructions contain very few words but many images.

The LEGO website has all of its kits instructions available for download, the link is here: https://www.lego.com/en-us/service/buildinginstructions

They have helped people build creations for decades and most of that is done with pictures (though partly because they are catering to children who may not be able to read yet). Another alternative is IKEA building instructions which are also primarily visual.

Here's an example from LEGO kit number 11006.



There's still some **context** and **definition** needed, even with these instructions. Can you see the symbols that need defining? The arrow and the 'rotate' symbol. Both of these are contextualised by the images before and after them. Before the rotate symbol, the LEGO in 2 is upside down, in 3 the rotate symbol is present and the image of the piece is flipped.

Similarly, the image where the arrow first appears and the one after it show that the piece has started at the blunt end of the arrow and been places where the point is. It's telling your brain where to put the block without you even knowing it!

Want more?

Here are some further activities, online resources, assessment ideas and curriculum references.

Adapting this activity

If students really want a challenge, they can sit back to back with each other. The student that designed the creation has to explain how to build it to the other student. They are not allowed to look at what the other student is doing. It adds complexity but also increases the obviousness of where language might fail in their instructions.

With some careful planning, this activity can be run over a video conferencing setup. However you must make sure that students have access to the same LEGO pieces.

Keep the conversation going

- Is it easier to build the creation if you know what it is supposed to be?
- Is it easier to write instructions in words or in pictures?
- Is it easier to read instructions in words or in pictures?
- What if the person who was building your creation was colourblind? How could you help them find the right blocks? How important are colours to your creation?
- What were some strategies that you used?
- What do you need to tell the person building your LEGO so that the instructions work?
- If you could design your own LEGO piece, what would it look like? Where could you use it?

Keep learning

Try drawing using Blockly code blocks here: cmp.ac/blocklytree

For teachers creating a portfolio of learning or considering this task for assessment

Ask students to run this activity with a member of their family. Have them report on the success/failure of their build as well as feedback from their 'builder'.

Based on the feedback from the builder and observations of their own they should update the instructions to be clearer. They should then run another build trial and record the results.

They could also conduct research on building instructions (provided by you or found independently, suggestions are LEGO, IKEA) and write what findings they draw from the examples.

Linking it back to the Australian Curriculum: Digital Technologies

Algorithms
Define simple problems, and describe and follow a sequence of steps and decisions (algorithms) needed to solve them (ACTDIP010 - see cmp.ac/algorithms) (3-4)

Specification
Define problems in terms of data and functional requirements drawing on previously solved problems (ACTDIP017 - see cmp.ac/specification) (5-6)

Refer to aca.edu.au/curriculum for more curriculum information.