Teach Computing

Embed and emphasise computational thinking creatively

National Centre for Computing Education

Course objectives

- ➔ Give ideas to teach computer science which utilises
- ➔ unplugged activities
- ➔ free online sources
- ➔ cross curriculum themes
- ➔ *(focusing on the programming aspects)*

Where do you go for resources?

- ➔ https://www.barefootcomputing.org/primary-computing-resources
- ➔ teachcomputing.org/resources

Everything you need from key stages 1 to 4, including: lesson plans / slides and worksheets / homework / assessment opportunities

Barefoot
Computing at School

Teach
Computing

Where do I go for help?

➔ Local Computing Hub (email)

@CompHubLGS (twitter)

➔ https://teachcomputing.org/courses

➔ https://www.computingatschool.org.uk/

➔ https://www.digitalschoolhouse.org.uk/

Teach Computing
London & Berkshire.

Langley Grammar School.

National Centre for Computing Education

Computing at School

DIGITAL
SCHOOLHOUSE

Clarifying key terms

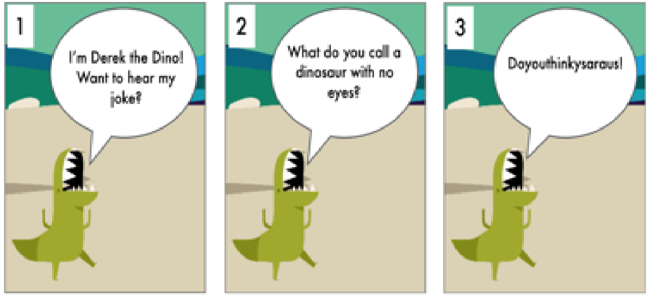
What is programming?

Adapted from : barefootcomputing.org

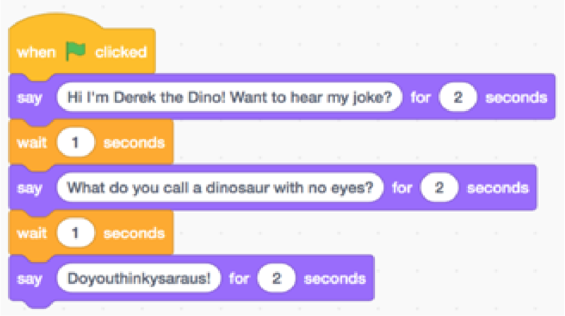
Design including an **algorithm**

coding

=


1
I'm Derek the Dino! Want to hear my joke?
2
What do you call a dinosaur with no eyes?
3
Doyouthinkysaraus!

+

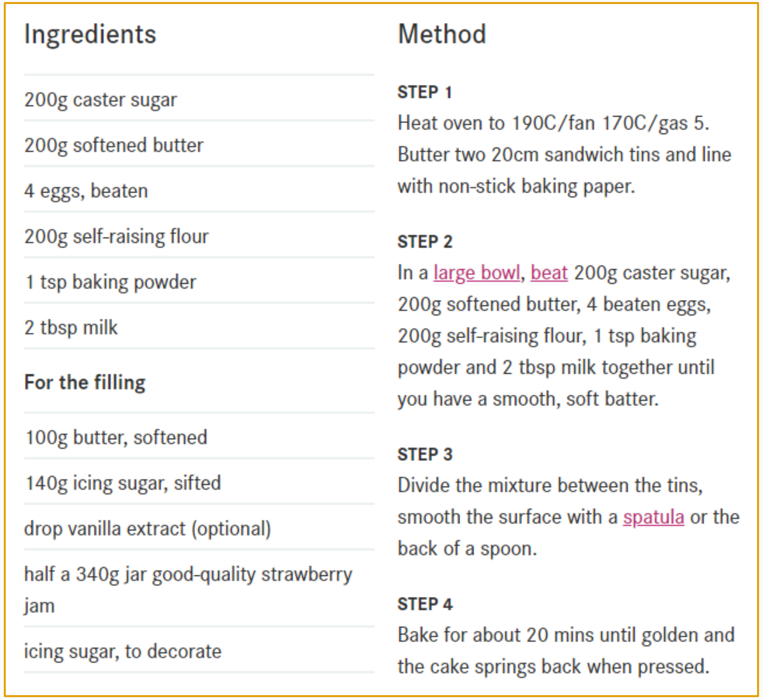


```
when 🏁 clicked
say (Hi I'm Derek the Dino! Want to hear my joke?) for (2) seconds
wait (1) seconds
say (What do you call a dinosaur with no eyes?) for (2) seconds
wait (1) seconds
say (Doyouthinkysaraus!) for (2) seconds
```

Deciding on the sequence of steps or rules needed to complete the task.

Implementing the design and algorithm in a language the computer understands (e.g. Scratch)

Algorithm



Ingredients

200g caster sugar

200g softened butter

4 eggs, beaten

200g self-raising flour

1 tsp baking powder

2 tbsp milk

For the filling

100g butter, softened

140g icing sugar, sifted

drop vanilla extract (optional)

half a 340g jar good-quality strawberry jam

icing sugar, to decorate

Method

STEP 1

Heat oven to 190C/fan 170C/gas 5. Butter two 20cm sandwich tins and line with non-stick baking paper.

STEP 2

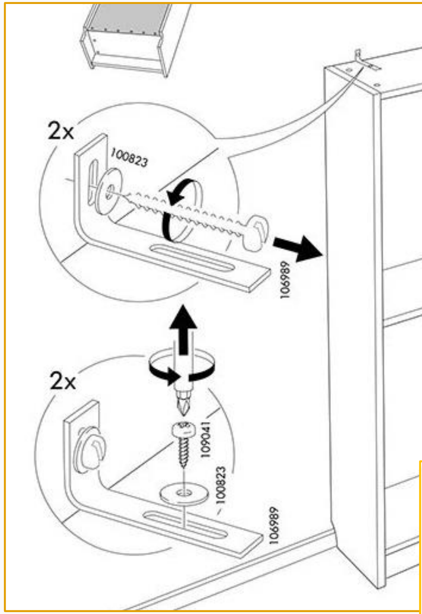
In a large bowl, beat 200g caster sugar, 200g softened butter, 4 beaten eggs, 200g self-raising flour, 1 tsp baking powder and 2 tbsp milk together until you have a smooth, soft batter.

STEP 3

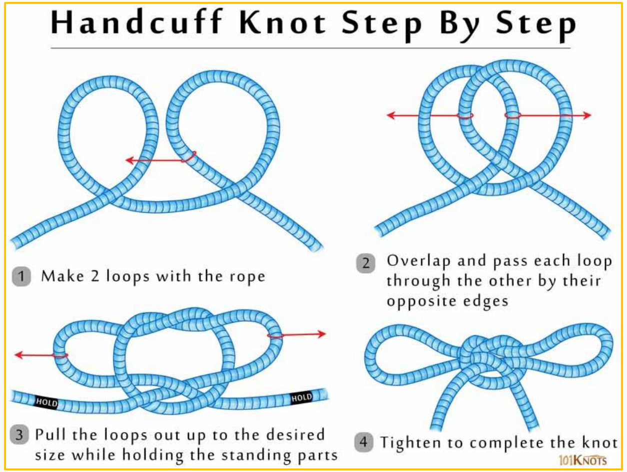
Divide the mixture between the tins, smooth the surface with a spatula or the back of a spoon.

STEP 4

Bake for about 20 mins until golden and the cake springs back when pressed.



Algorithms



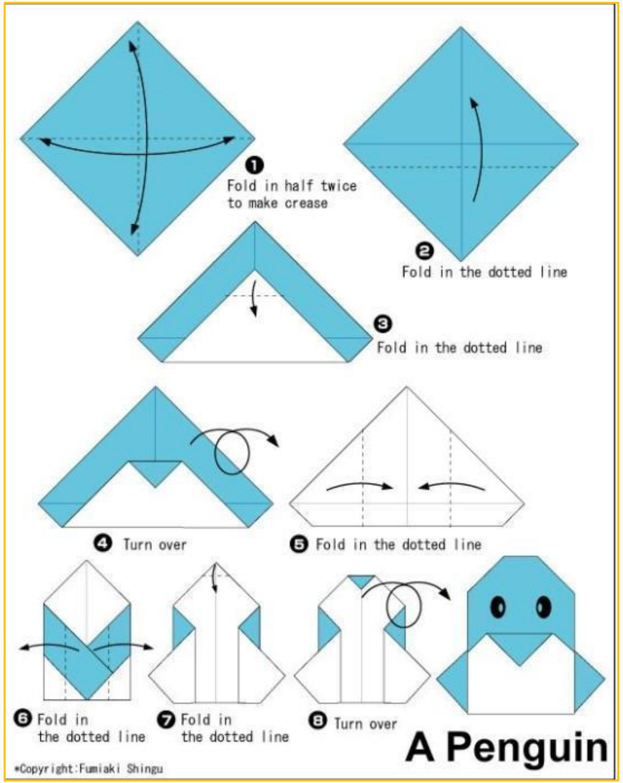
Handcuff Knot Step By Step

1 Make 2 loops with the rope

2 Overlap and pass each loop through the other by their opposite edges

3 Pull the loops out up to the desired size while holding the standing parts

4 Tighten to complete the knot



1 Fold in half twice to make crease

2 Fold in the dotted line

3 Fold in the dotted line

4 Turn over

5 Fold in the dotted line

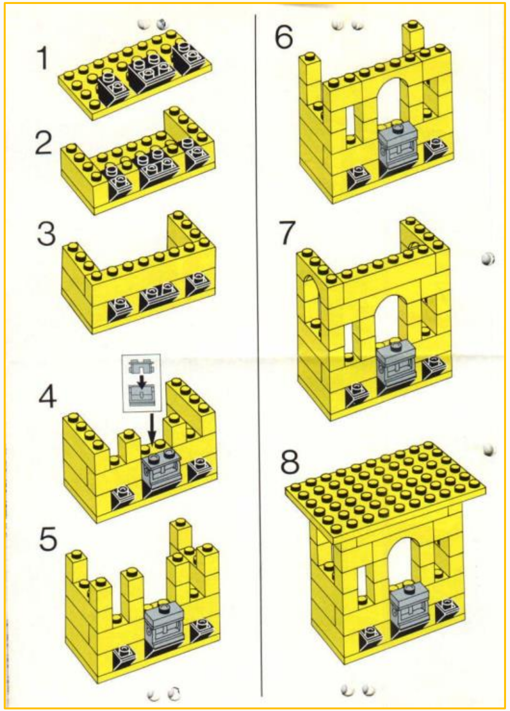
6 Fold in the dotted line

7 Fold in the dotted line

8 Turn over

A Penguin

*Copyright:Fumiaki Shingu



Terminology

http://code-it.co.uk/csvocab

https://github.com/pddring/computing-keywords/wiki

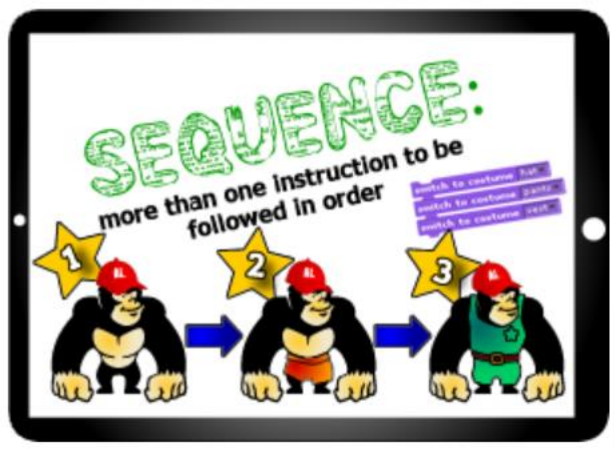
ALGORITHM:

step by step instructions to solve a problem

REPETITION:

doing the same instruction more than once

repeat until number of bananas = 0
think Feed me!



SEQUENCE:

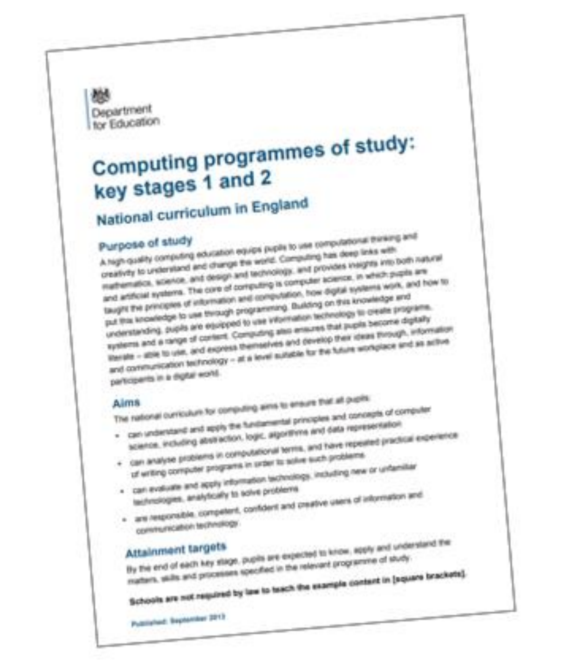
more than one instruction to be followed in order

SELECTION:

when your program has to make a choice

if colour = Yellow
say Yum Yum!
else
think Maybe not...
? ? ?

Focus



Department for Education

Computing programmes of study: key stages 1 and 2

National curriculum in England

Purpose of study

A high-quality computing education equips pupils to use computational thinking and creativity to understand and change the world. Computing has deep links with mathematics, science, and design and technology, and provides insights into both natural and artificial systems. The core of computing is computer science, in which pupils are taught the principles of information and computation, how digital systems work, and how to put this knowledge to use through programming. Building on this knowledge and understanding, pupils are equipped to use information technology to create programs, systems and a range of content. Computing also ensures that pupils become digitally literate – able to use, and express themselves and develop their ideas through, information and communication technology – at a level suitable for the future workplace and as active participants in a digital world.

Aims

The national curriculum for computing aims to ensure that all pupils:

- can understand and apply the fundamental principles and concepts of computer science, including abstraction, logic, algorithms and data representation
- can analyse problems in computational terms, and have repeated practical experience of writing computer programs in order to solve such problems
- can evaluate and apply information technology, including new or unfamiliar technologies, analytically to solve problems
- are responsible, competent, confident and creative users of information and communication technology

Attainment targets

By the end of each key stage, pupils are expected to know, apply and understand the matters, skills and processes specified in the relevant programme of study.

Schools are not required by law to teach the example content in [square brackets].

Published: September 2013

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https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/239033/PRIMARY_national_curriculum_-_Computing.pdf

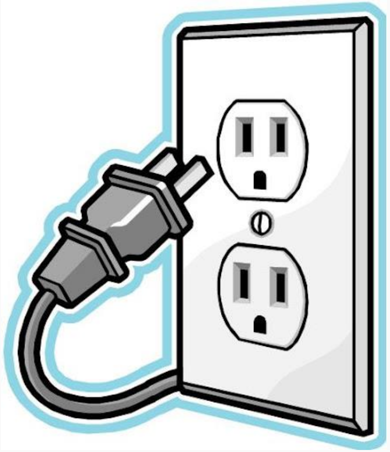
Activities

Embed and emphasise computational thinking creatively using constructionist play based learning techniques to introduce and explore new concepts.

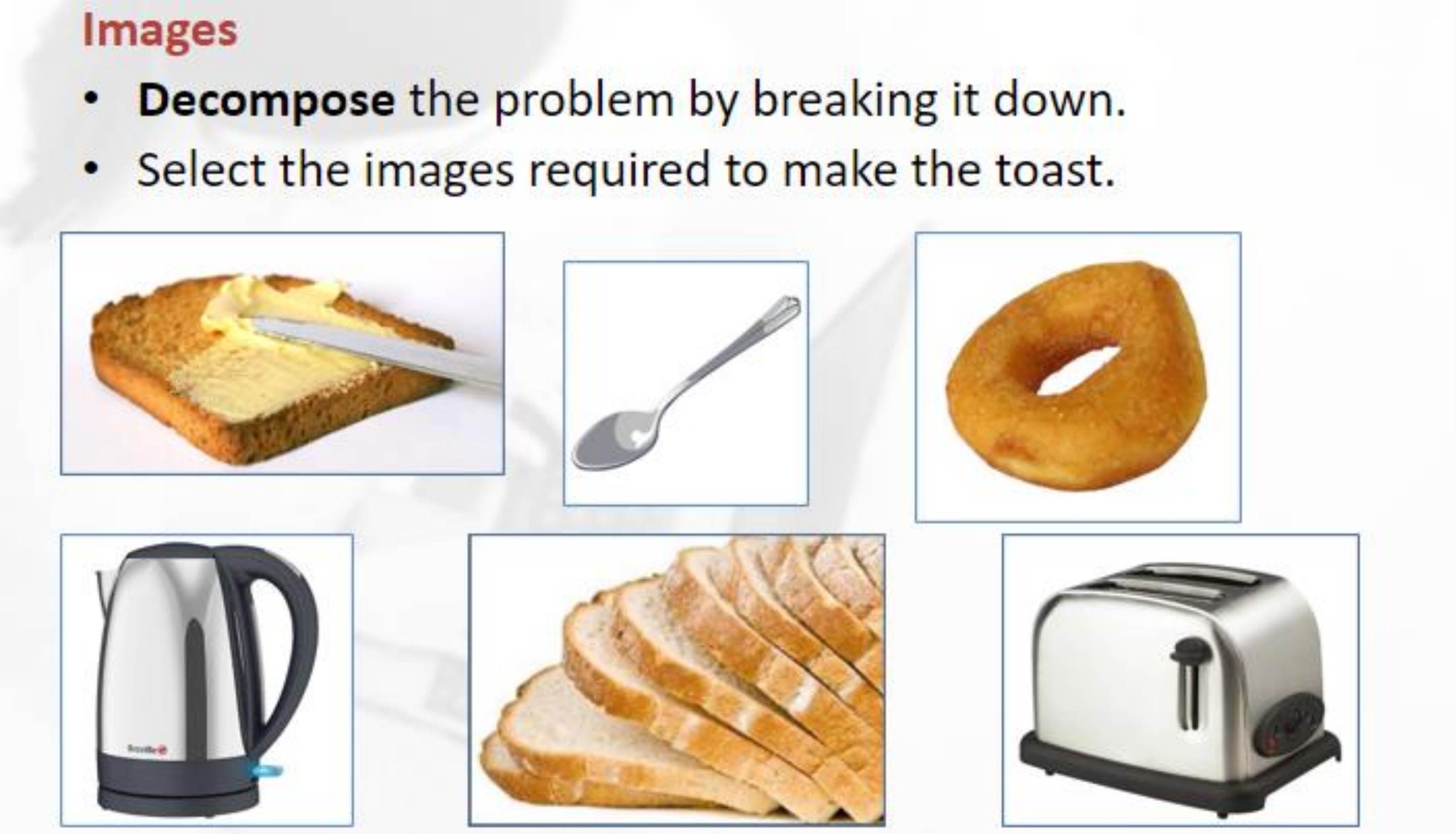
Unplugged activities without using devices

Online free web based resources

Cross curricular themes (project based)



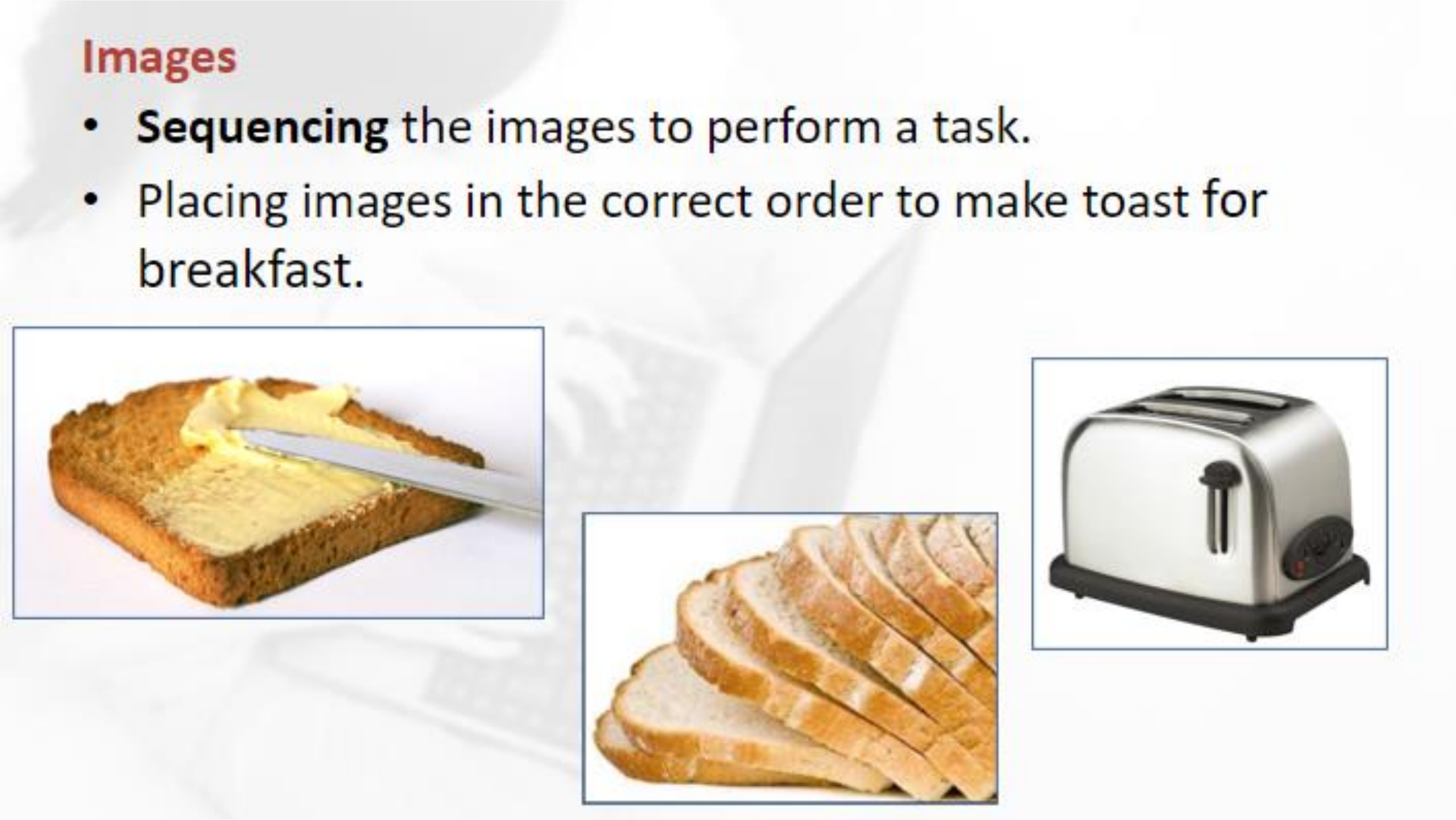
Shopping list



Images

- **Decompose** the problem by breaking it down.
- Select the images required to make the toast.

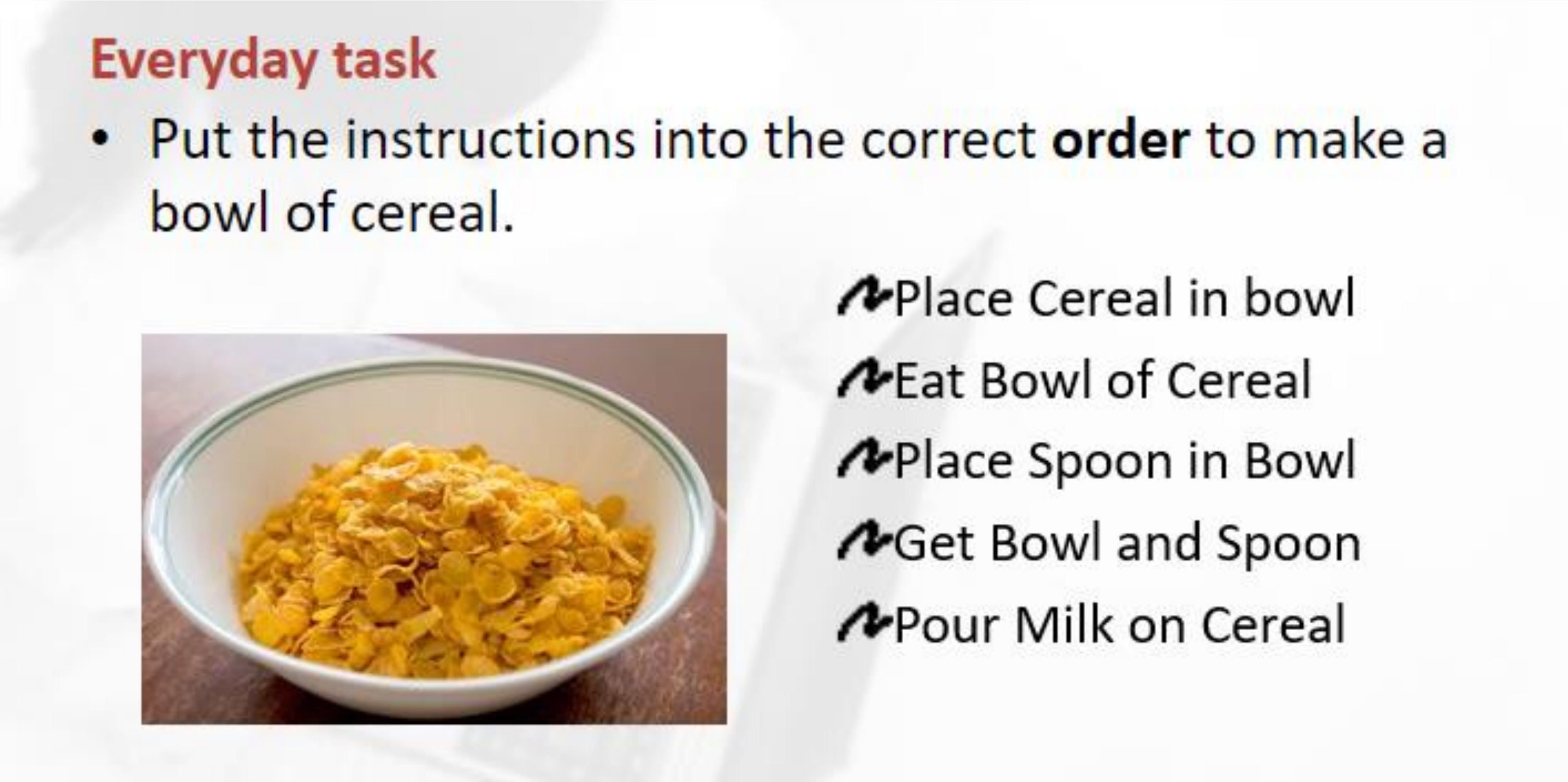
Instructions



Images

- **Sequencing** the images to perform a task.
- Placing images in the correct order to make toast for breakfast.

Instructions

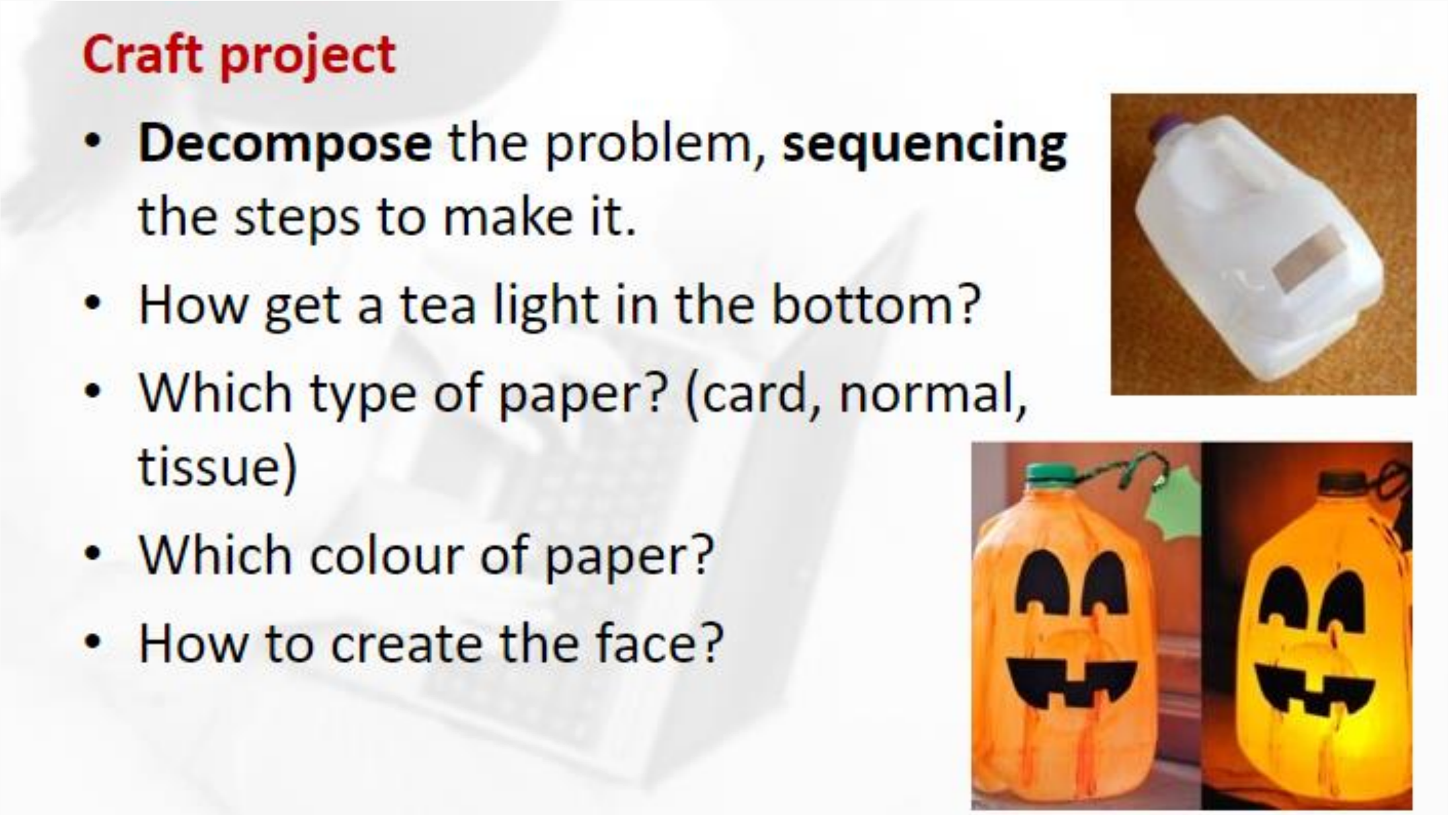


Everyday task

- Put the instructions into the correct **order** to make a bowl of cereal.

- Place Cereal in bowl
- Eat Bowl of Cereal
- Place Spoon in Bowl
- Get Bowl and Spoon
- Pour Milk on Cereal

Topical ideas

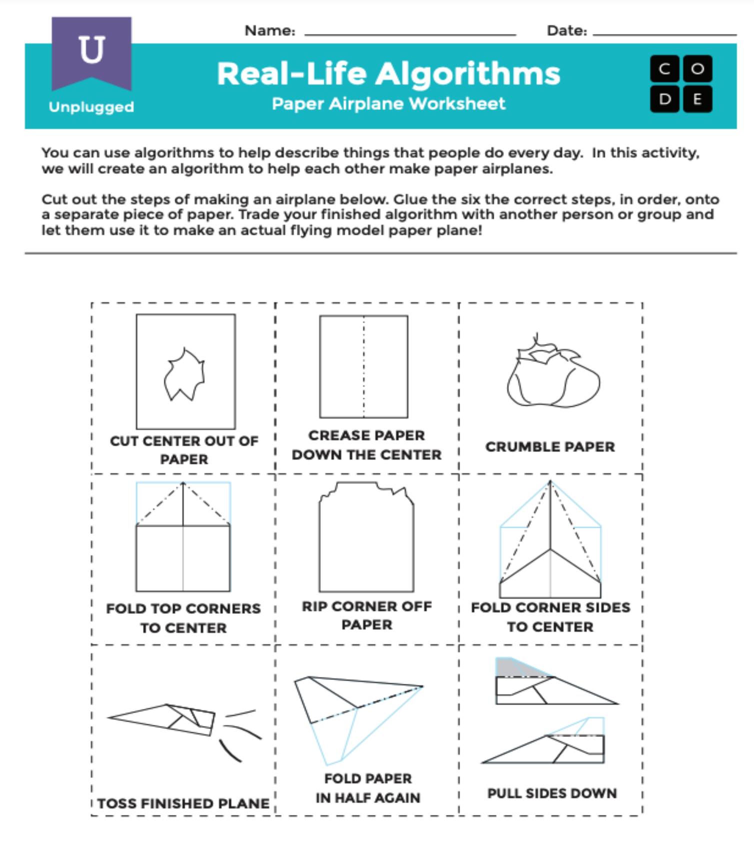


Craft project

- **Decompose** the problem, **sequencing** the steps to make it.
- How get a tea light in the bottom?
- Which type of paper? (card, normal, tissue)
- Which colour of paper?
- How to create the face?

Origami

https://code.org/curriculum/course2/2/Teacher
https://www.origami-fun.com/origami-for-kids.html



Name: ______________ Date: ________

Unplugged

Real-Life Algorithms

Paper Airplane Worksheet

You can use algorithms to help describe things that people do every day. In this activity, we will create an algorithm to help each other make paper airplanes.

Cut out the steps of making an airplane below. Glue the six the correct steps, in order, onto a separate piece of paper. Trade your finished algorithm with another person or group and let them use it to make an actual flying model paper plane!

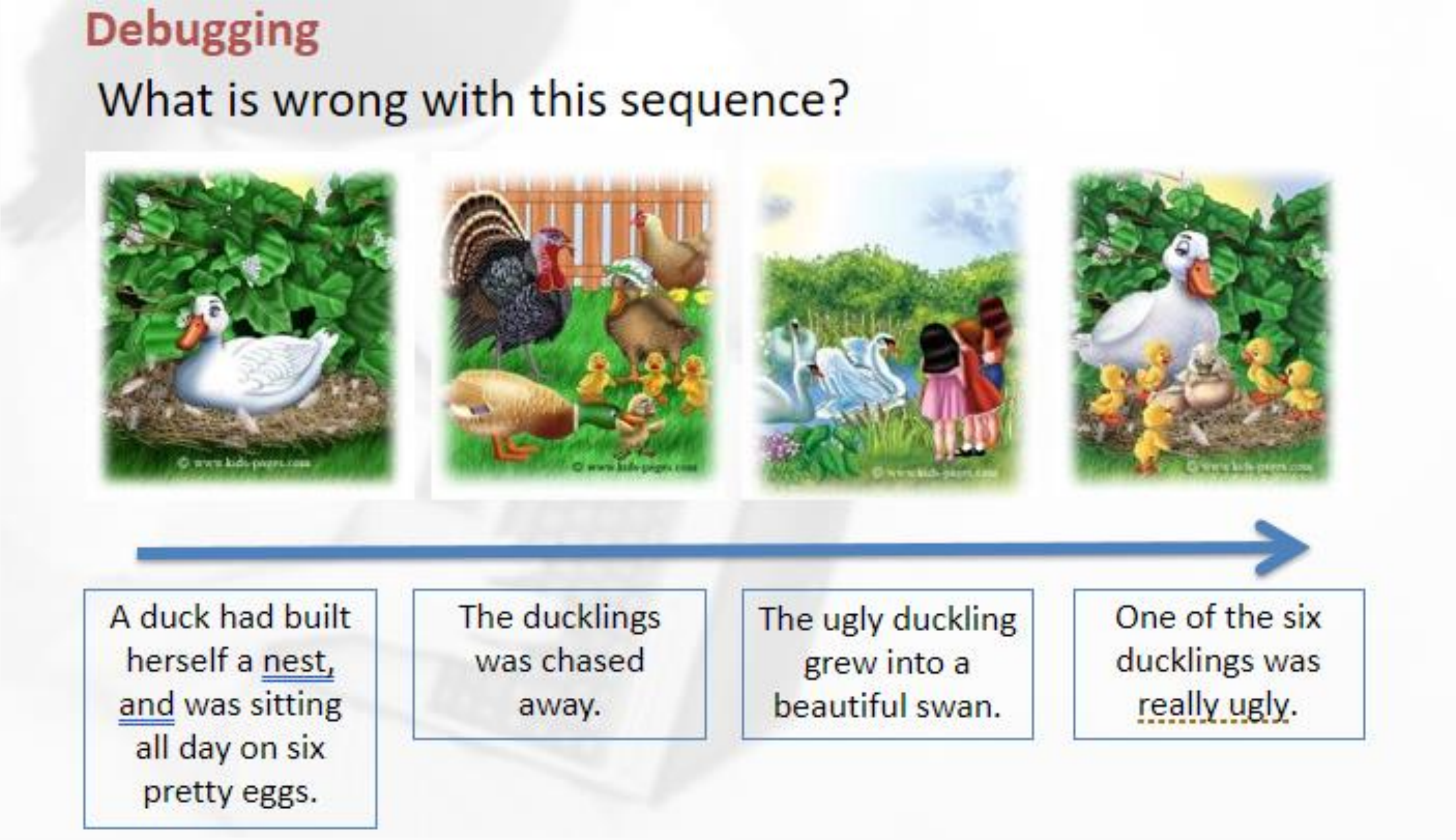
CUT CENTER OUT OF PAPER	CREASE PAPER DOWN THE CENTER	CRUMBLE PAPER
FOLD TOP CORNERS TO CENTER	RIP CORNER OFF PAPER	FOLD CORNER SIDES TO CENTER
TOSS FINISHED PLANE	FOLD PAPER IN HALF AGAIN	PULL SIDES DOWN

Story telling

Telling a story

- Placing images in a **sequence** to tell a story.

Story telling



Debugging

What is wrong with this sequence?

A duck had built herself a nest, and was sitting all day on six pretty eggs.

The ducklings was chased away.

The ugly duckling grew into a beautiful swan.

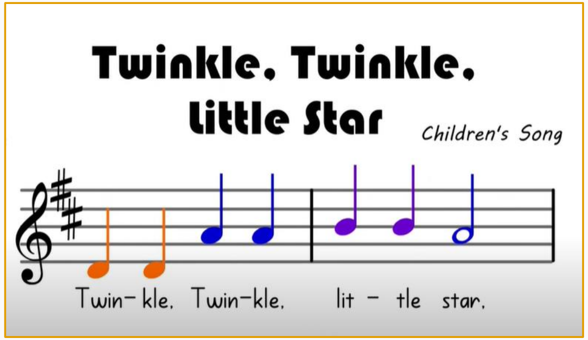
One of the six ducklings was really ugly.

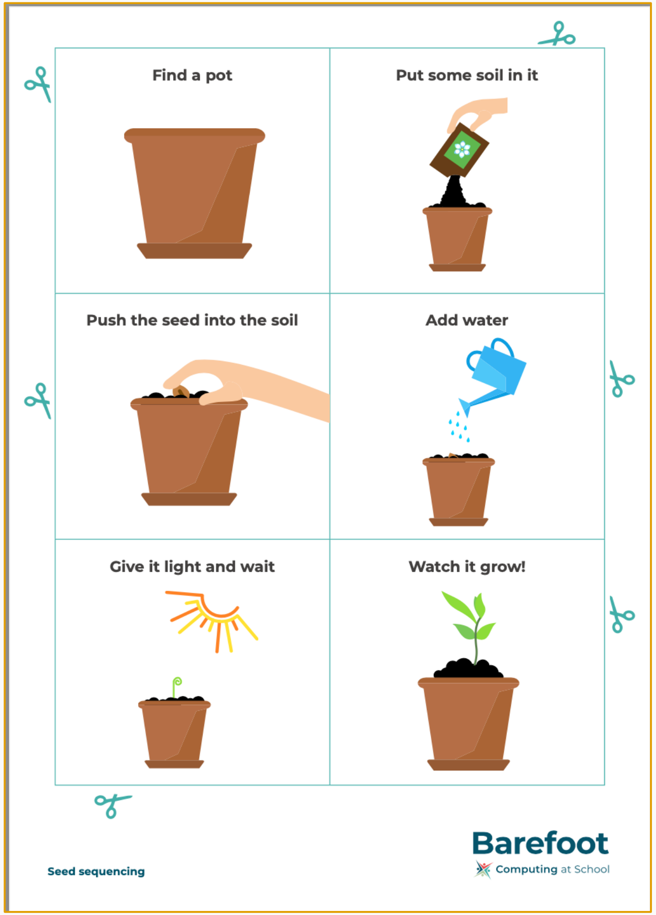
Sequencing

Growing Plants

https://www.barefootcomputing.org/earlyyears

Creating simple music





Find a pot

Put some soil in it

Push the seed into the soil

Add water

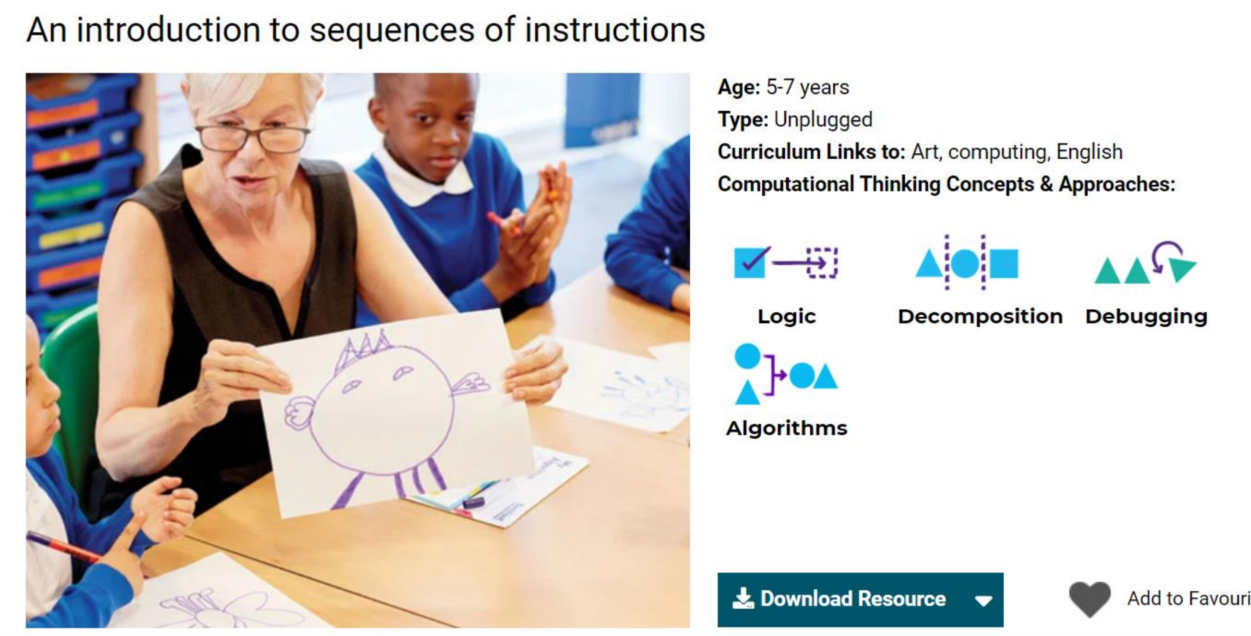
Give it light and wait

Watch it grow!

Seed sequencing

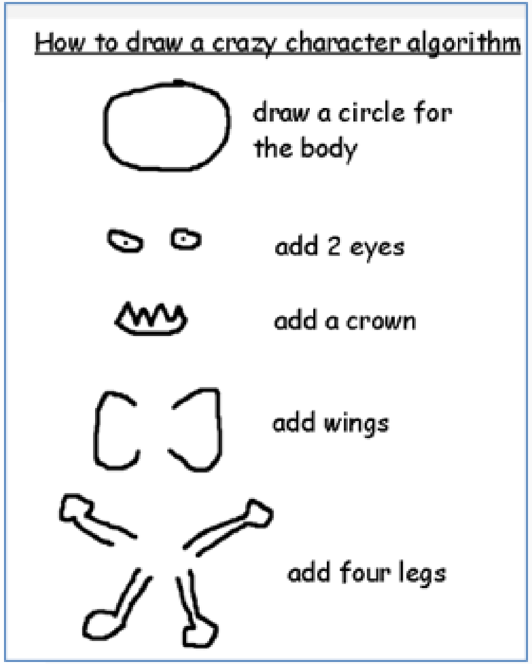
Barefoot
Computing at School

Crazy character algorithms



An introduction to sequences of instructions

Age: 5-7 years
Type: Unplugged
Curriculum Links to: Art, computing, English
Computational Thinking Concepts & Approaches:



How to draw a crazy character algorithm

draw a circle for the body

add 2 eyes

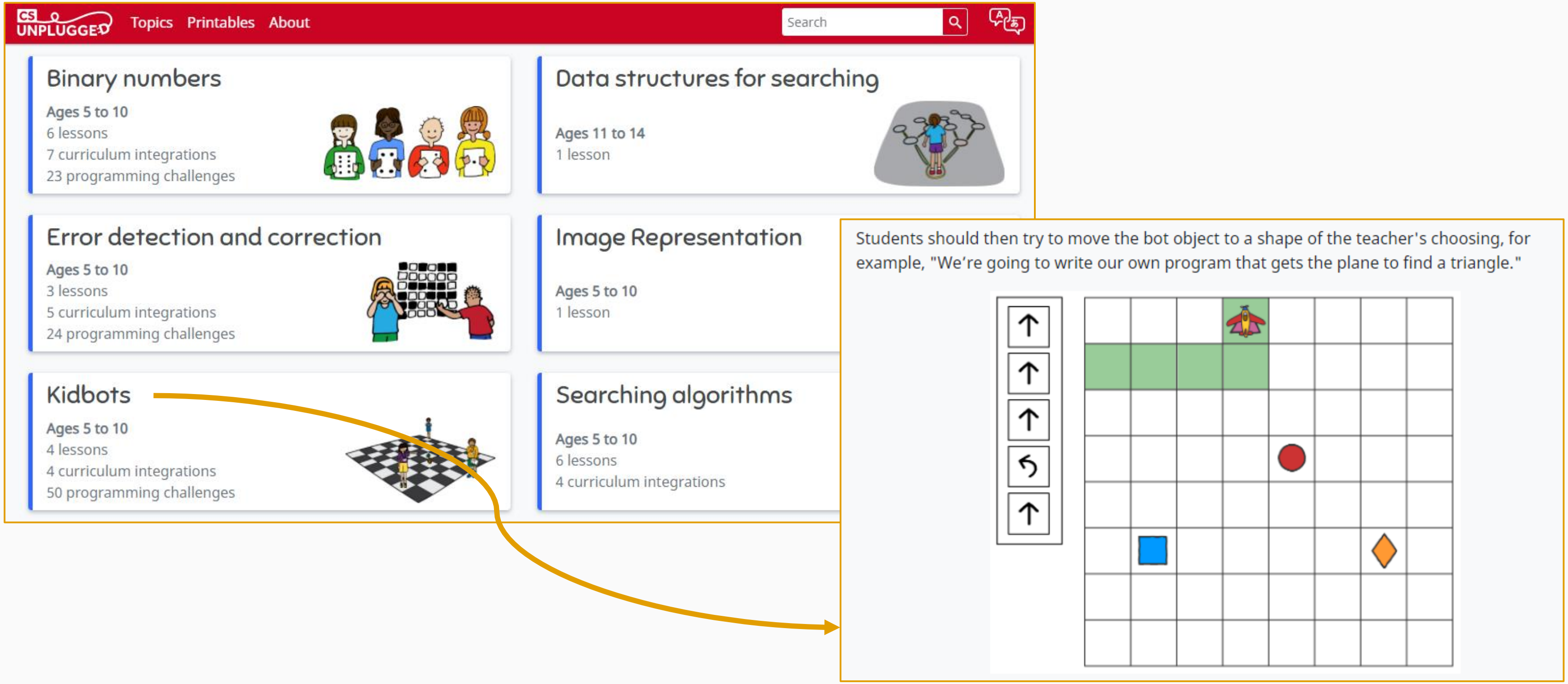
add a crown

add wings

add four legs

https://www.barefootcomputing.org/resources/crazy-character-algorithms

Web site for unplugged ideas



Binary numbers

Ages 5 to 10
6 lessons
7 curriculum integrations
23 programming challenges

Data structures for searching

Ages 11 to 14
1 lesson

Error detection and correction

Ages 5 to 10
3 lessons
5 curriculum integrations
24 programming challenges

Image Representation

Ages 5 to 10
1 lesson

Kidbots

Ages 5 to 10
4 lessons
4 curriculum integrations
50 programming challenges

Searching algorithms

Ages 5 to 10
6 lessons
4 curriculum integrations

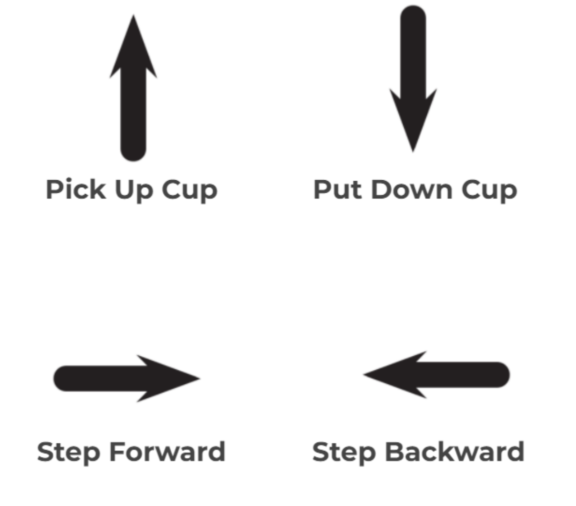
Students should then try to move the bot object to a shape of the teacher's choosing, for example, "We're going to write our own program that gets the plane to find a triangle."

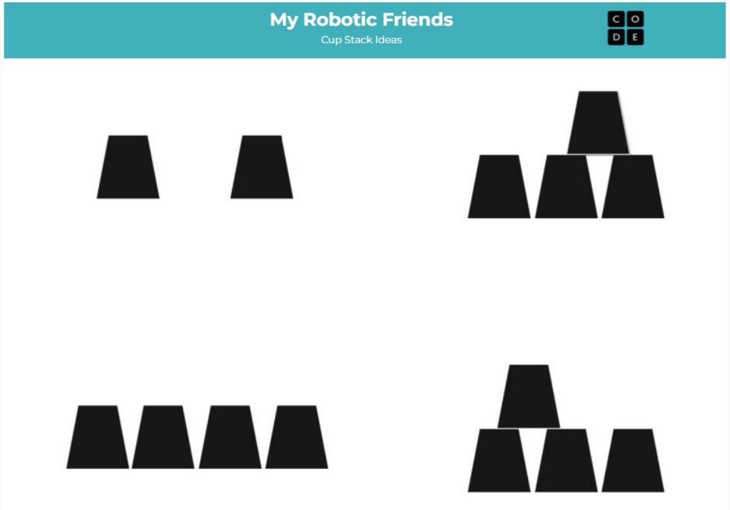
https://www.csunplugged.org/en/topics/

Cup Stacking

Sequencing

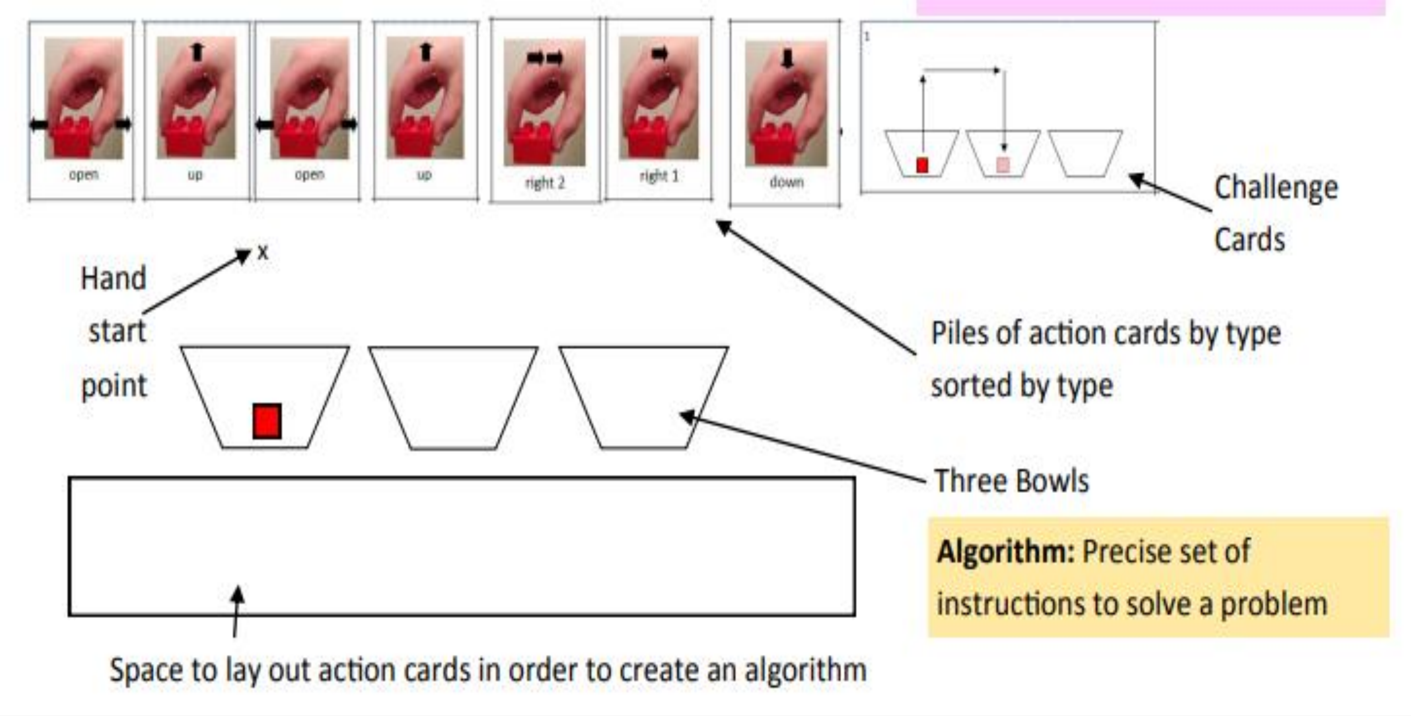
https://studio.code.org/s/coursec-2021/lessons/2#section-279





Human crane

http://code-it.co.uk/ks1/crane/humancrane



Challenge Cards

Hand start point

Piles of action cards by type sorted by type

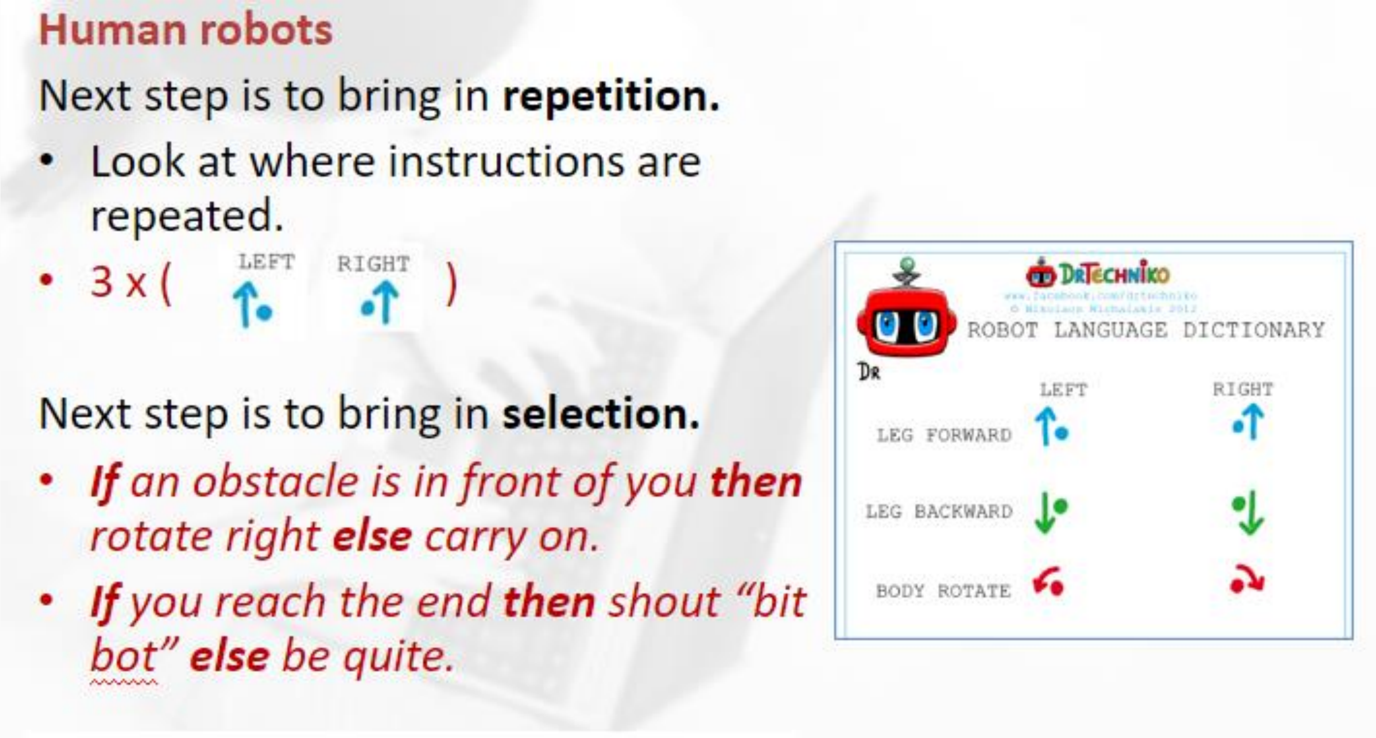
Three Bowls

Algorithm: Precise set of instructions to solve a problem

Space to lay out action cards in order to create an algorithm

Human robots

http://drtechniko.com/2012/04/09/how-to-train-your-robot/



Human robots

Next step is to bring in **repetition.**

- Look at where instructions are repeated.
- 3 x (LEFT ↑• RIGHT •↑)

Next step is to bring in **selection.**

- ***If*** *an obstacle is in front of you* ***then*** *rotate right* ***else*** *carry on.*
- ***If*** *you reach the end* ***then*** *shout "bit bot"* ***else*** *be quite.*

DrTechniko

www.facebook.com/drtechniko

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DR

ROBOT LANGUAGE DICTIONARY

	LEFT	RIGHT
LEG FORWARD	↑•	•↑
LEG BACKWARD	↓•	•↓
BODY ROTATE	↶	↷

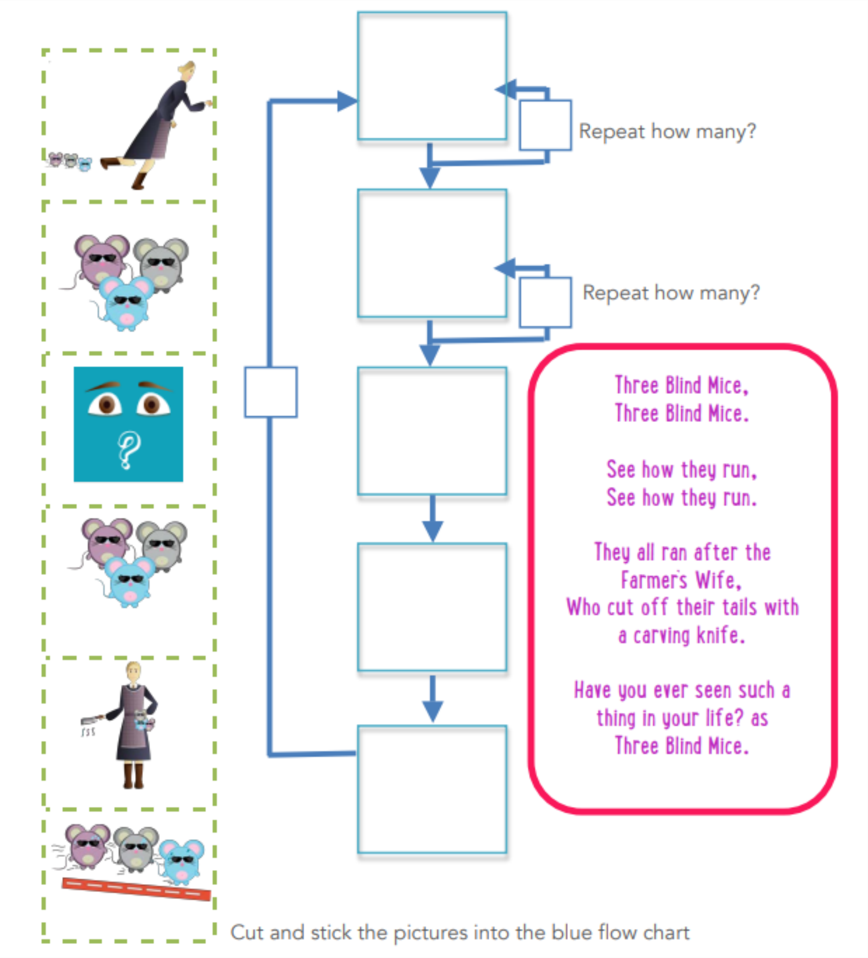
Dance moves

https://www.barefootcomputing.org/docs/default-source/at-home/dance_moves_supporting_worksheets.pdf?sfvrsn=754791ea_0

Flowcharts - repeats

Nursey Rhymes

https://www.icompute-uk.com/Downloads/iCompute-HOC-iMake-Algorithms.pdf



Three Blind Mice,
Three Blind Mice.

See how they run,
See how they run.

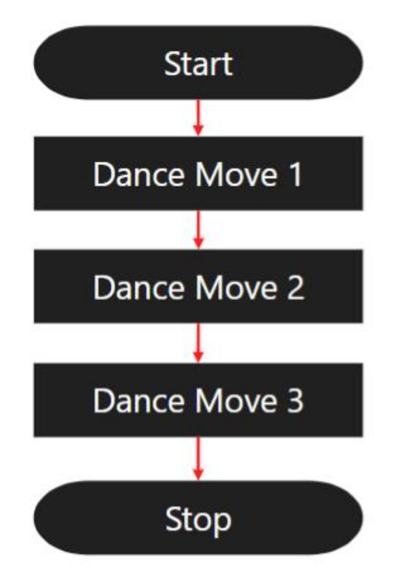
They all ran after the
Farmer's Wife,
Who cut off their tails with
a carving knife.

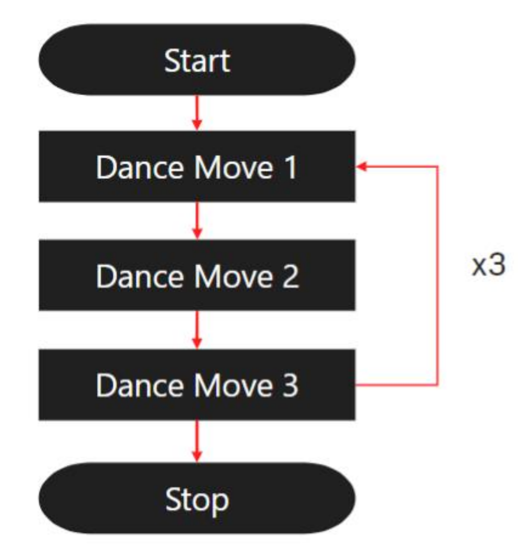
Have you ever seen such a
thing in your life? as
Three Blind Mice.

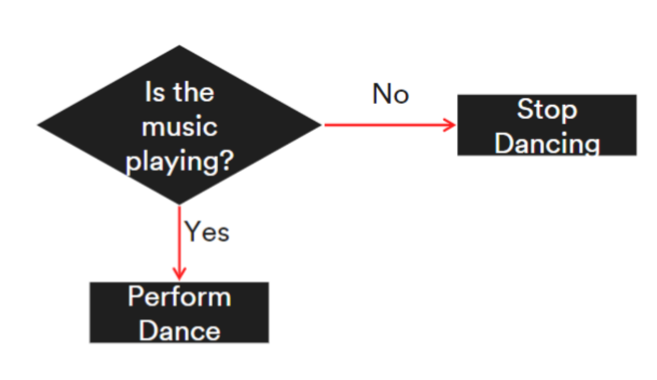
Cut and stick the pictures into the blue flow chart

Flowcharts

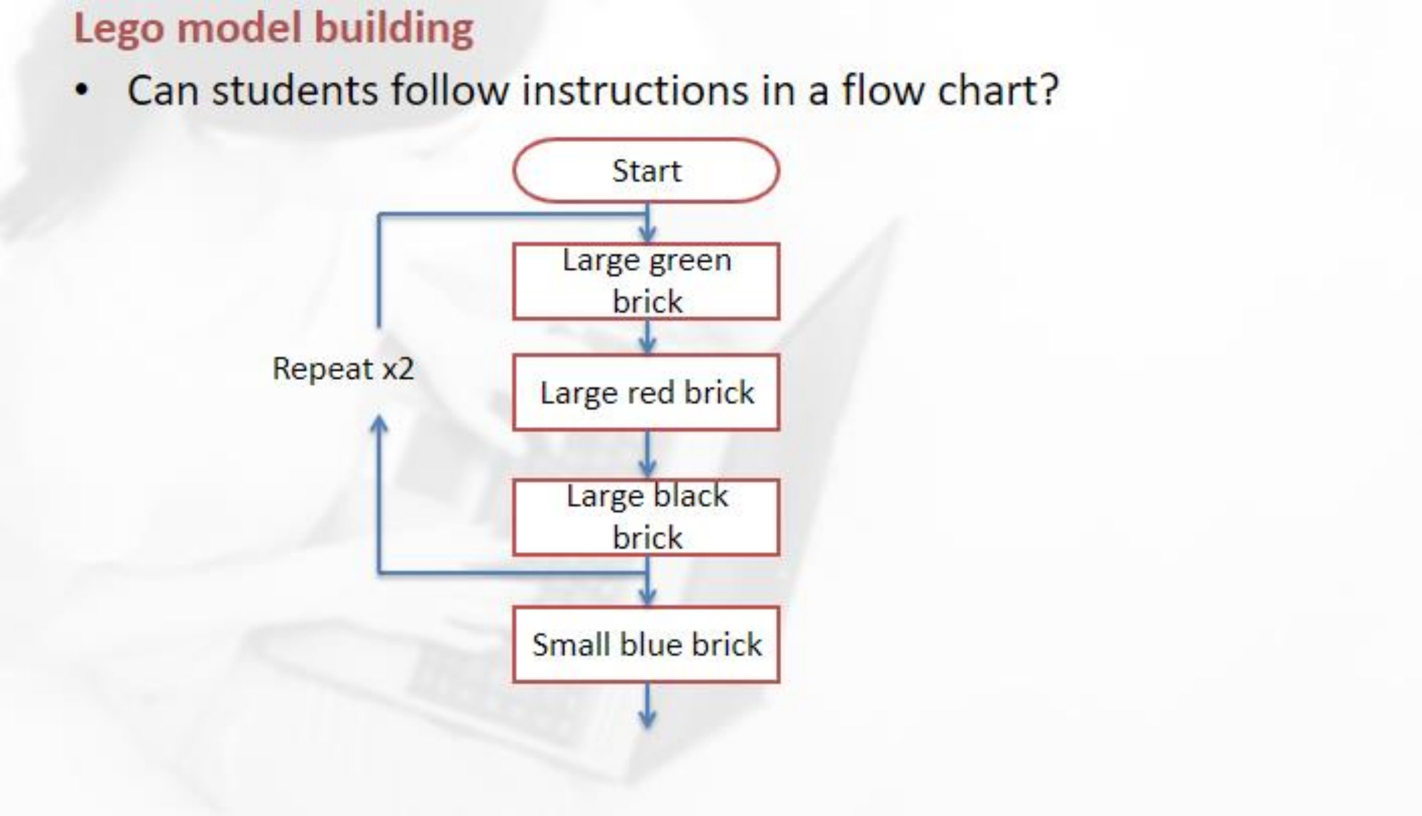
- ➔ Sequence
- ➔ Repeats
- ➔ Selection







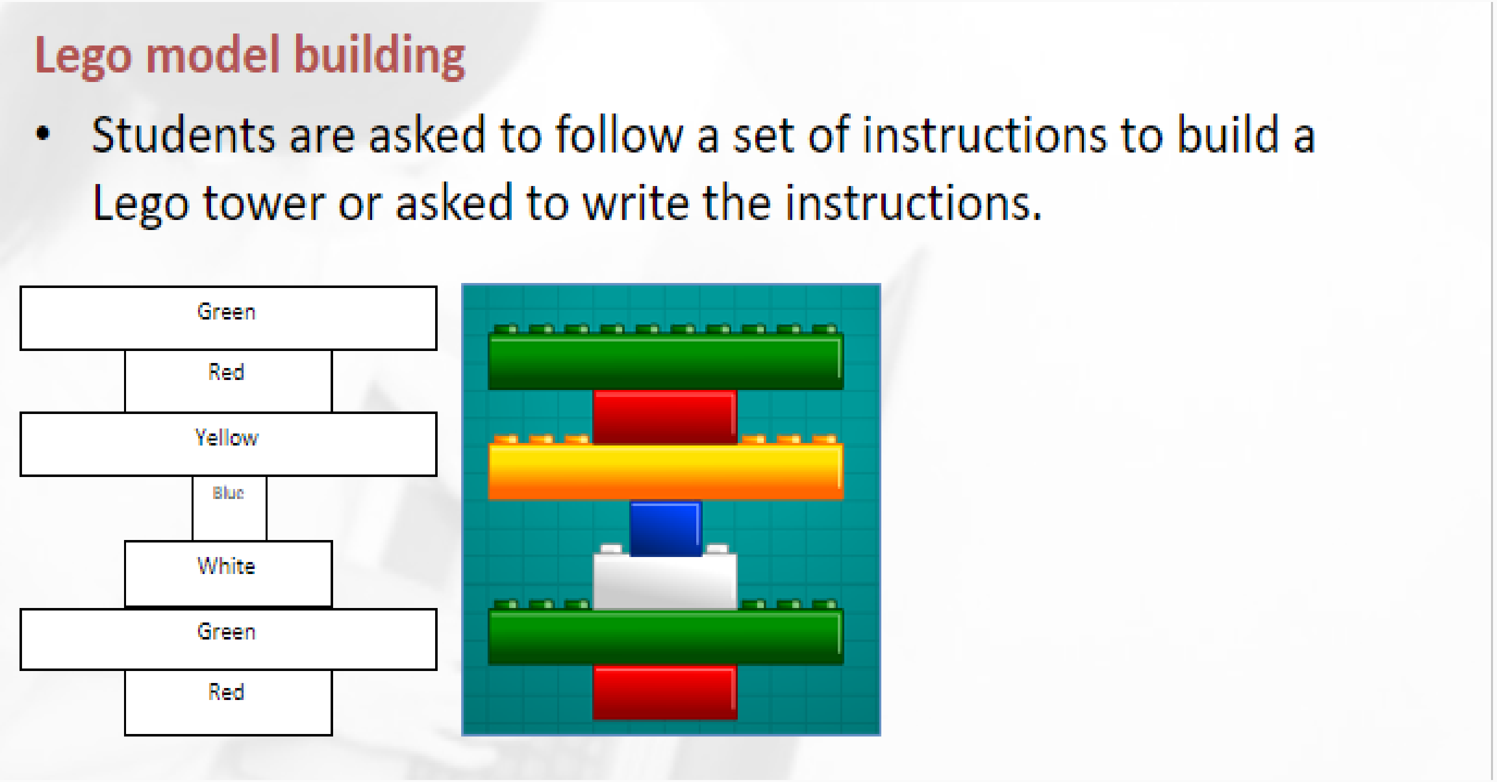
Flowcharts - repeats



Lego model building

- Can students follow instructions in a flow chart?

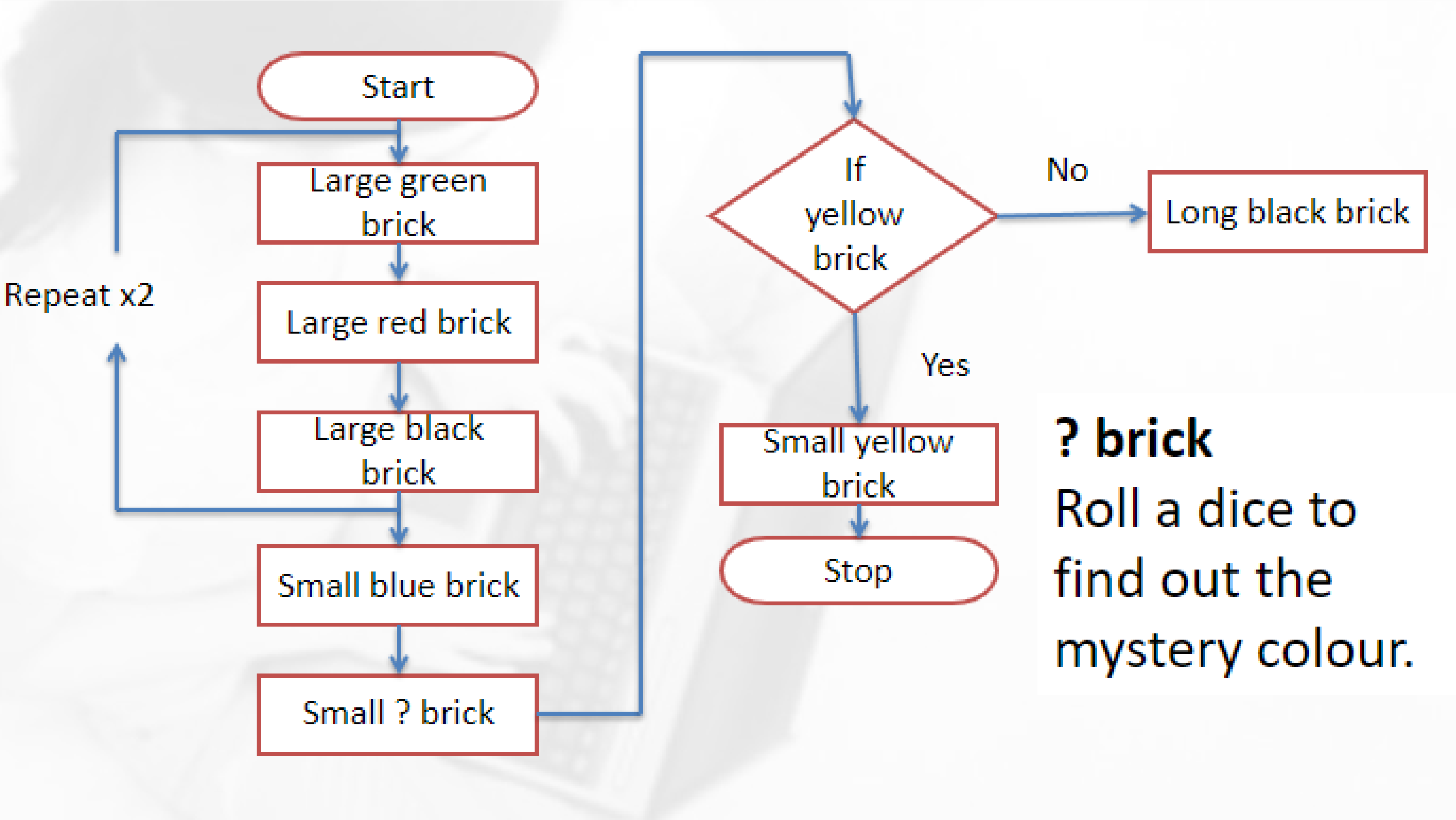
Model building



Lego model building

- Students are asked to follow a set of instructions to build a Lego tower or asked to write the instructions.

Extension - conditions



? brick

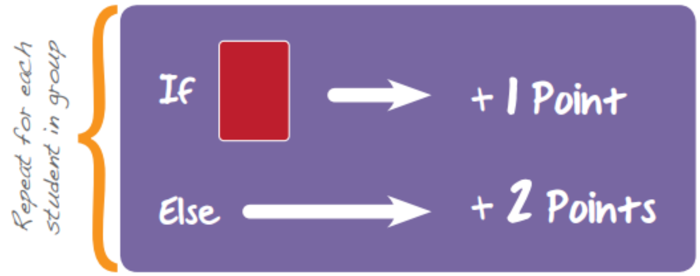
Roll a dice to find out the mystery colour.

Conditions

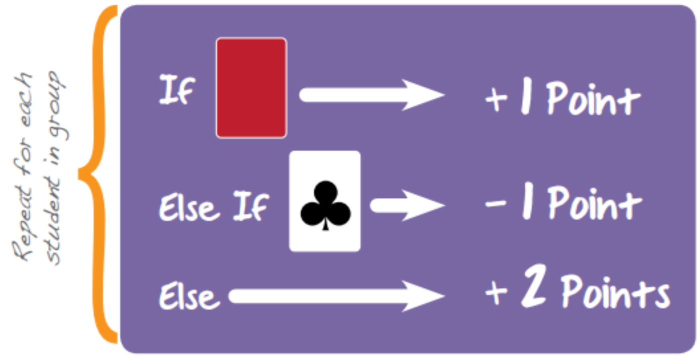
Conditions with playing cards

https://code.org/files/ConditionalsHoC.pdf

Sample algorithm #1

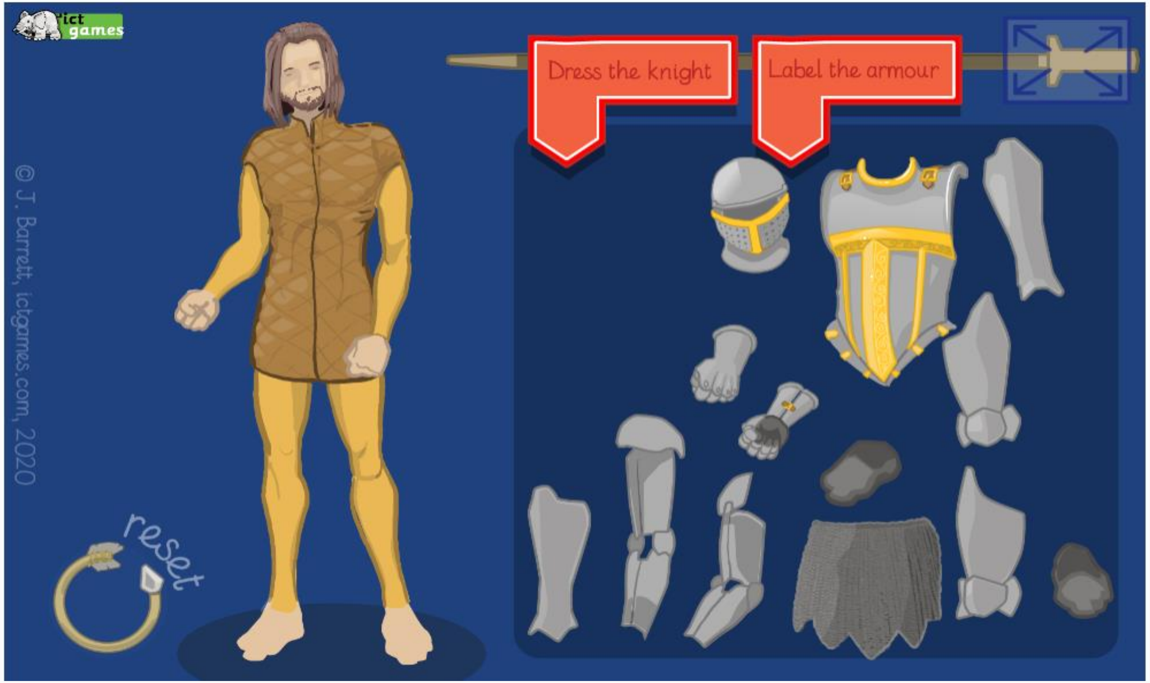


Sample algorithm #2



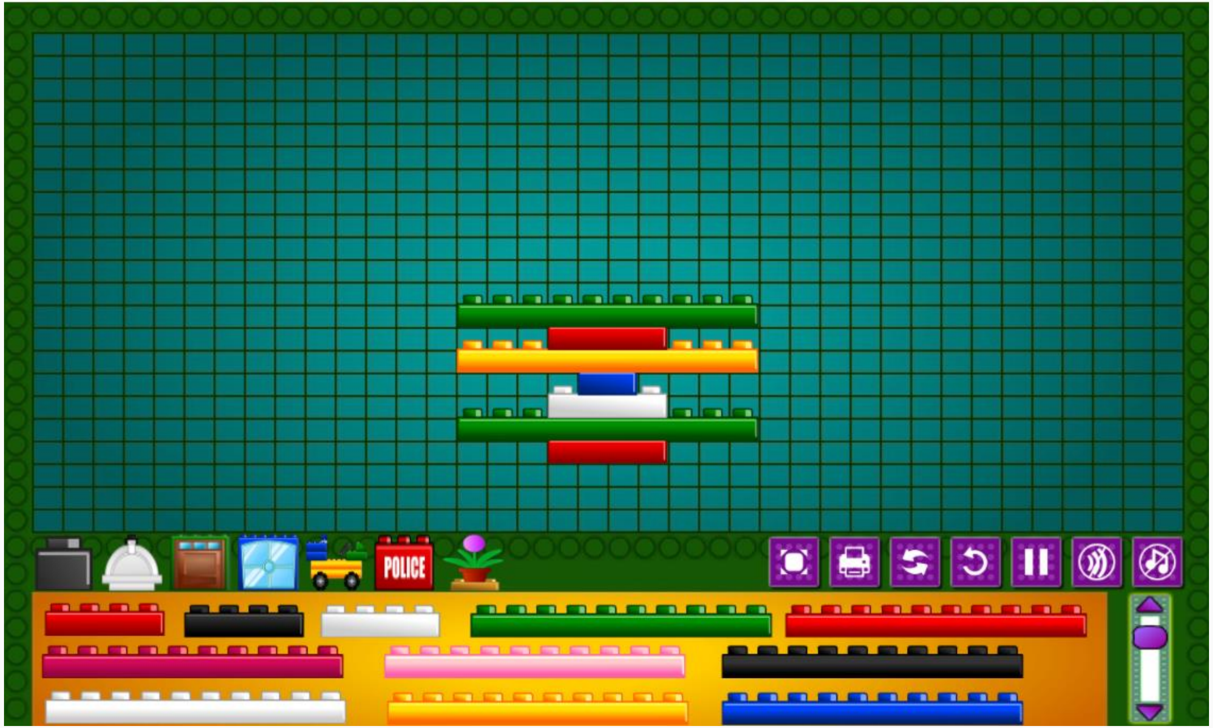
Online games

https://www.ictgames.com/mobilePage/knight/index.html



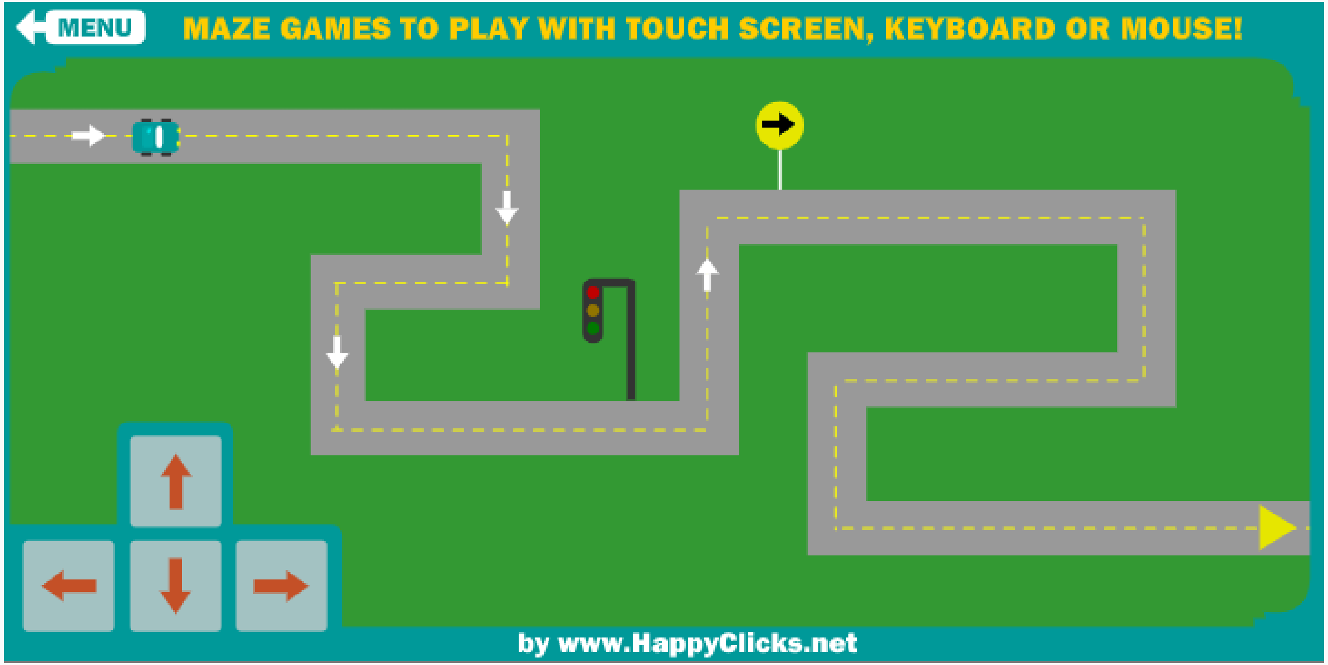
Online game

https://www.brickbuildinggame.com/



Maze activity

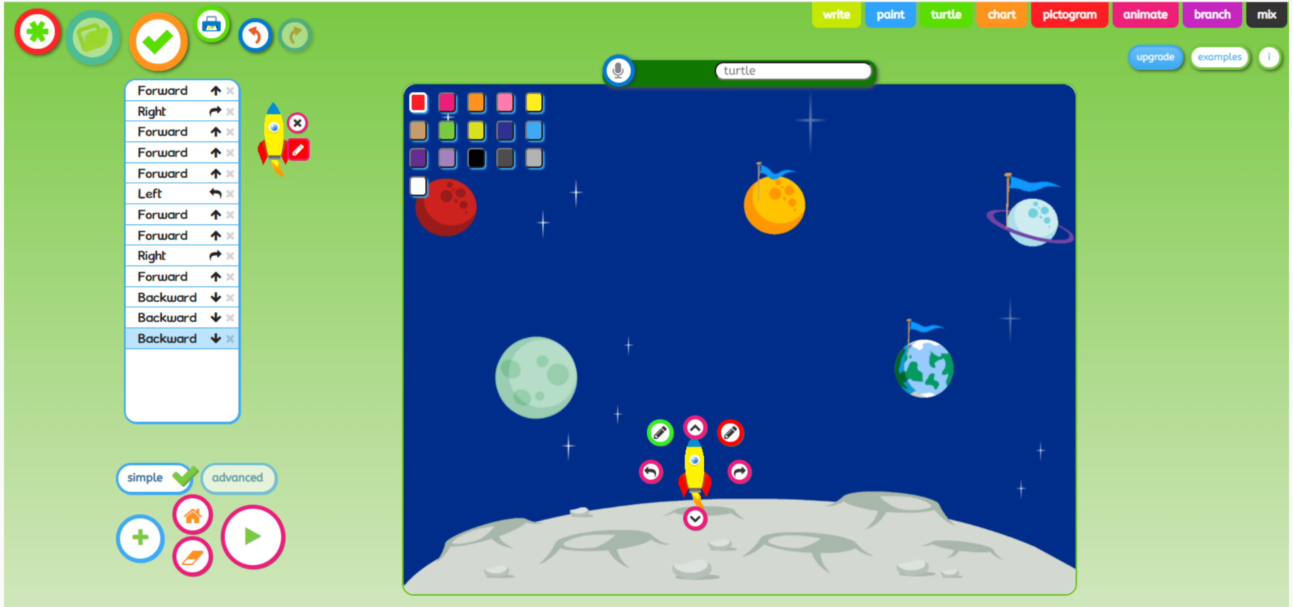
https://www.happyclicks.net/maze-games/index.php



Online sequencing

https://www.j2e.com/j2code/

https://www.j2e.com/jit5#turtle

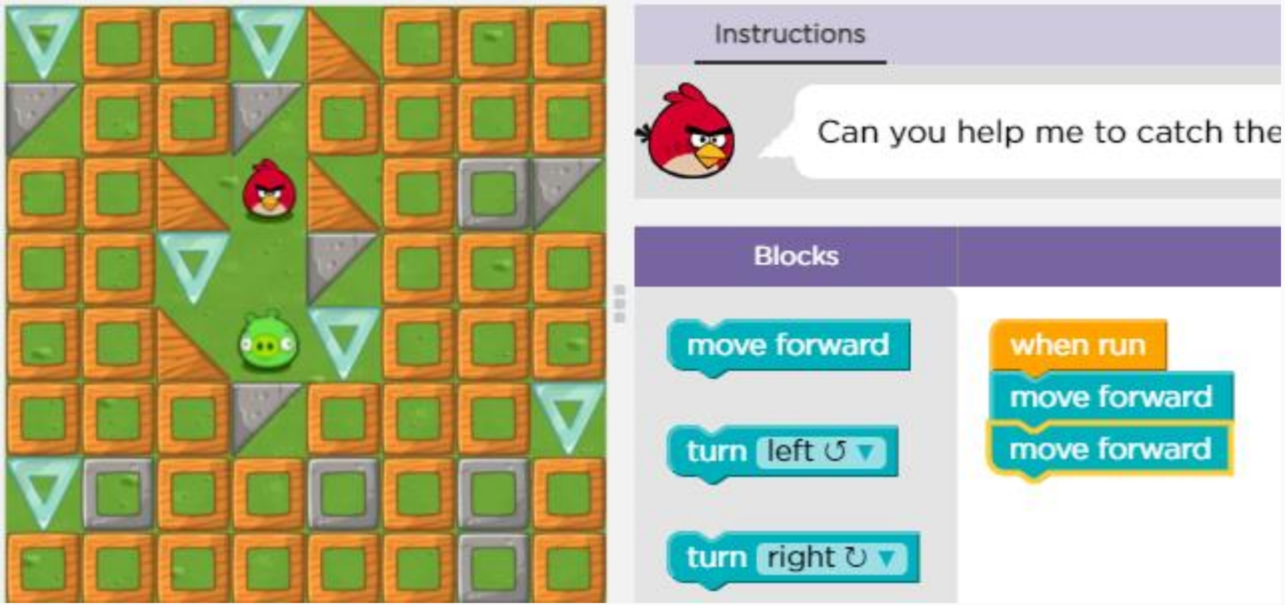


```
Forward ↑
Right ↱
Forward ↑
Forward ↑
Forward ↑
Left ↰
Forward ↑
Forward ↑
Right ↱
Forward ↑
Backward ↓
Backward ↓
Backward ↓
```

Block coding

https://studio.code.org/s/course2/lessons/3/levels/1

https://studio.code.org/hoc/1



Can you help me to catch the

```
when run
move forward
move forward
```

Practical Exploration

PLAY

Have a go at the activity – What do pupils do ?

INCLUDE

How might you adapt the activity for vulnerable groups

EXPLORE

What else is there available within this resources?

REFLECT

What prior knowledge will pupils need in order to engage successfully with the activity?

Are there potential barriers to you delivering this lesson?

What is the potential use of the activity within your own teaching?

Teach Computing

Thank you
Any questions?

Stacey Jenkins

National Centre for Computing Education