STEM SHOWDOWN

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STEMIE

efa Education Futures ACADEMY

University of South Australia

STEM Showdown

Scoring

Every worksheet must be signed off by the teacher for each part completed. Each signature is worth 1 point.

There is also a speed bonus for tasks that can be completed at different rates:

- 1st to finish: 3 point bonus
- 2nd: 2 points
- 3rd : 1 point

Additional awards are given for:

- Creativity
- Persistence
- Encouragement

To record this, add comments to worksheets that reflect the value that was shown like “Great persistence!” so that you can count up these comments to track each student’s standings for these awards.

Note that ‘Get Ready to Ride’ cannot be finished first, instead bonus points are given for the slowest successful course, the the slowest taking 3 bonus points, the next slowest taking 2, etc.

Note: STEM boxes are highlighted to show which STEM components are the focus of each activity, the CDFS boxes highlight which cognitive skills are employed, with notes at the end of each in more detail. The four are ‘Computational Thinking,’ ‘Design Thinking,’ ‘Futures Thinking’ and ‘Systems Thinking’

This score grid is for a quick breakdown of how the workshop will need to be run:

Mess made	How much tidying up will be needed	/10
Teacher involvement	How much help you are likely to have to give	/10
Resources needed	How much stuff you will need to provide	/10

Note: “Resources needed” with a high score does not necessarily mean lots of different resources, it could also mean a big class set of one thing. Often these sets are available from UniSA, so always check before writing off an activity!

Mystery Message

S T E M

C D F S

Individual Team

Mess made 1 /10

Teacher involement 4 /10

Resources needed 2 /10

Required Resources

- Sound files from the UniSA Stem Showdown page. If giving students laptops and headphones, they will need to be directed to the activity link 'Mystery Message' under the Stem Showdown 1 tab, this will have the sound file for them to use.
- Worksheet page 1 and page 2, plus pencil per student.
- Page 3 is extension activites and should be available on request if you are saving paper. This page requires coloured discs (also available to print), or just three coloured pens/pencils, for each student doing the activity.

Step it Up with:
A laptop and headphones for each student so they can go at their own pace

Recharge with:
A laptop and headphones for each student so they can go at their own pace

Accessibility Note:
Students with audio processing difficulties may benefit from an individual device with headphones. Colour blind or visually impaired students may need additional consideration for the extension activity.

Task
Something has happened on board the International Space Station. Mission Control cannot reach the astronauts on the radio, but a pulsing pattern is coming in as the radio seems to be being turned on and off. We believe the astronauts are using the on/off switch to send a Morse Code message. You need to translate the message and find out what is happening.

- Listen to the message
- Write down the dots, dashes and breaks
- Use the tables and charts on the next page to decode the message

Mystery Message

Teacher Notes

Morse code can be sent by almost anything you can turn on and off, if someone can receive it. You don't have to be listening: a telescope trained on the ISS could see a torch being turned on and off. Morse is not a binary code (two letters) of just dots and dashes, but a ternary (three letter) code of dot, dash, and break. It can be translated into binary of 01, 11, and 00 respectively, and humans read it by translating it into the 57 letter alphabet it encodes. I don't know what to call that... septoquindenary? Kevin?

Many other varieties of signaling languages exist, like using flags for semaphore. Later they will create their own language as an extension.
Astronauts often must improvise in an emergency, using what they have rather than what they wished they had. Something just like this happens in 'The Martian" where he gets a camera to point at different letters to receive messages: https://youtu.be/NttUBB98zg4

Answer to Mystery Message: Get A Rocket

If multiple classes are involved with this challenge, and have been supplied the answer by other students you can use the alternative message

Answer to Alternative Mystery Message: Map A Rescue

If you want to create your own Morse Code Message MP3 files you can use this website. https://morsecode.world/international/trainer/generator.html

Be sure to adjust the timing to make it slow enough for everyone to be able to follow it. 5 or below is recommended, especially for the "Farnsworth speed" or gaps between characters. You can show them a message at the default speed with more information in it so they can see how efficient this could be when this was a more common form of communication.

If you wish to extend this activity even further, consider semaphore. They could consider flags waved from a boat or the bush, or even a remote controllable clock as a concept. Create your own semaphore messages at http://www.semaphorify.info/

The extension activity simply requires students create their own code, and consider how to encode numbers, so lots of different options can be offered depending on the available resources and applied creatively. For no additional resources at all, they could even hold up fingers, or position their arms.

Mystery Message

Context/story alternatives:

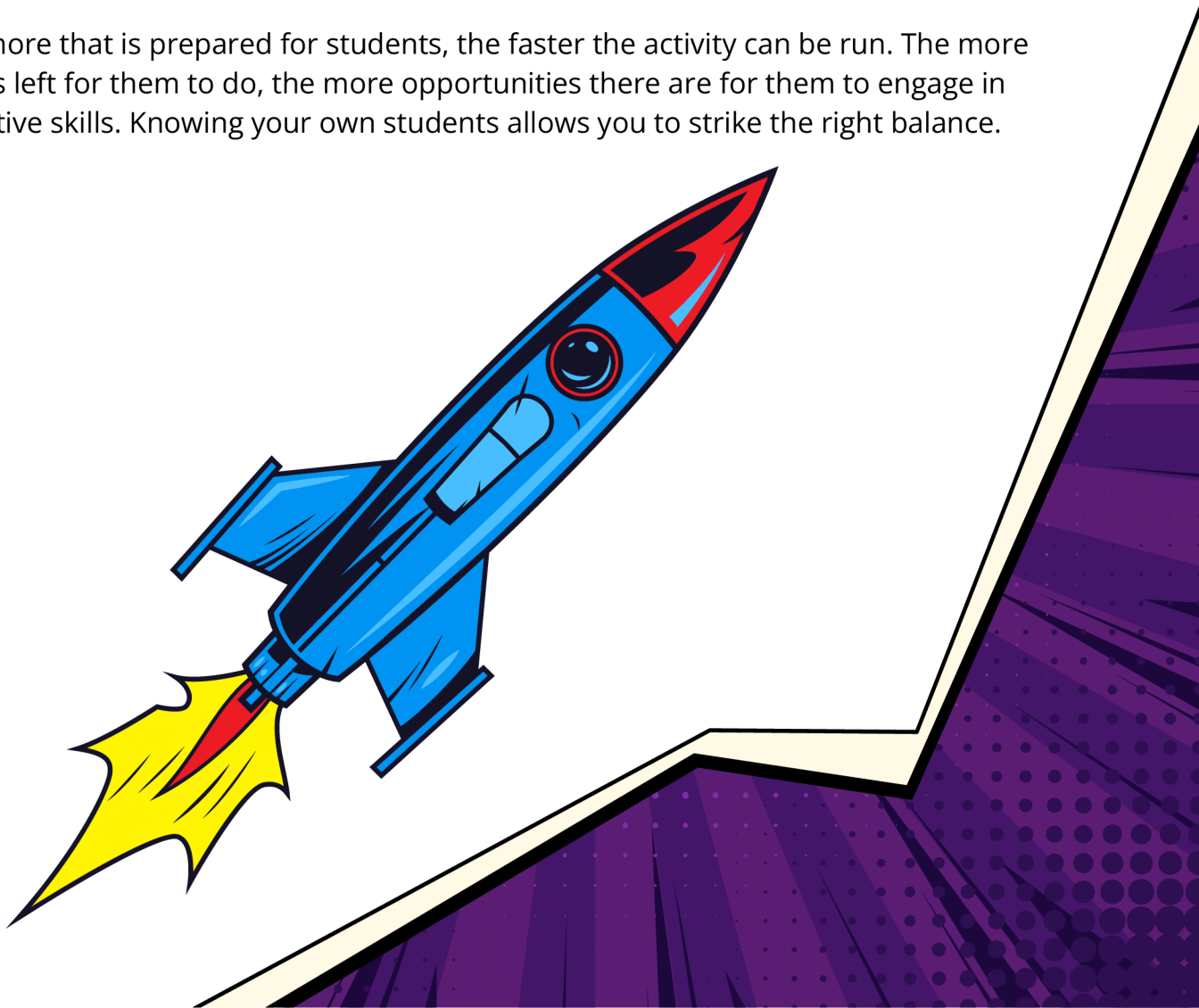
- Flashing lights from a boat; SOS: “Out of fuel”
- Static on a walkie in the bush; SOS: “Lost by fire”
- Friend code between neighbours: “Come over now”

Computational Thinking

- Pattern Recognition
- Algorithms
- Decomposition
- Abstraction
- Modelling and Simulation
- Evaluation

Decoding a message is primarily pattern recognition; they are looking for the patterns that match to letters. The flowchart is an example of an algorithm, but they are not using computational thinking by using it; they haven’t created it themselves. Developing a flowchart of their own for their own code from the extension task would fulfill this component of computational thinking.

The more that is prepared for students, the faster the activity can be run. The more that is left for them to do, the more opportunities there are for them to engage in cognitive skills. Knowing your own students allows you to strike the right balance.



Tangram Zoo

S T E M

C D F S

Individual Team

Mess made	3 /10
Teacher involement	3 /10
Resources needed	2 /10

Required Resources

- Scissors
- Pencils
- Worksheet (colouring optional)

Step it Up with:
Wooden or plastic tangram piece sets

Recharge with:
Fresh worksheets

Accessibility Note:
Students with colour blindness might benefit from a clear outline on the edge of each piece to distinguish them more clearly in a finished image

Task
The “Tangram Traveling Zoo” is going on a world tour, bringing amazing animals for people in lots of different countries to see. In each country they will even have ‘guest’ animals from other local zoos. They have decided that they need to have signs that they can change without remaking them, and that can be understood by visitors no matter what language they speak.

Colour and cut out the shapes from the sheet. Arrange these shapes without cutting them any futher to make pictures of each of their zoo animals for their signs. If students are struggling, you can give them a **help sheet**

If students solve all of the tangrams before time is up, they can create a design another animal of their choice tangram and even ask another student to solve it.

Tangram Zoo

Context/story alternatives:

- Signs for the “Touch a Truck” event that happens every term
- Warning signs for weather conditions that can be updated according to conditions (likely reduced difficulty)
- A world map

Computational Thinking and Design Thinking

The problem-solving element of this activity affords students the chance to engage in computational thinking, breaking down the silhouette of the image they are going to make into the pieces available, and evaluate their attempts as they fail and try again. They will also engage in small scale design thinking as they repeat their attempts to improve and get closer to the intended shape.
The alternative contexts skew more towards design thinking as they do not provide silhouettes to match, so participants are creating a pattern that could look a number of different ways, but communicates an image that they are imagining. This is more about ideation and prototyping than it is about breaking down a problem.

Get Ready to Ride

S T E M

C D F S

Individual **Team** -Recommended group size 2-3

Mess made	5 /10
Teacher involement	3 /10
Resources needed	5 /10

Required Resources Per group:

- 2 x Paper plates
- Tape
- Blu-tac
- 1 ping pong ball
- 2 sheets A4 paper
- Ruler
- Scissors
- Pencil
- Worksheet

Groups will need access to a table or chair to create the 25cm height requirement and 60cm distance requirement, students can tape or Blu-tac their design to the table or chair.

Step it Up with:
More varied materials and/or greater distances, use of toys with wheels instead of a ball

Recharge with:
Replacement tape, plates and paper

Task
Civil engineers design structures, these include bridges, buildings and roller coasters. Today, you are the engineer. Can you design the end of a rollercoaster ride that brings riders safely back to the start?

- You can only use these materials supplied to make your rollercoaster
- The rollercoaster must begin 25cm from the ground and span (travel) 60 cm.
- Your rollercoaster must allow a ping pong ball to travel safely without stopping or falling off along the way and it needs to travel from one paper plate to finish on the second paper.

Rules
The roller coaster must be free standing, it must be a continuous track.
The landing plate cannot be modified in any way, and nothing can be stuck to it. The starting plate and paper can be modified.

Get Ready to ride

As this is about safety, the slowest time wins - 1st place 3 additional points, 2nd place 2 additional points, 3rd place 1 additional point.

Context/story alternatives:

- Transit from the Adelaide Hills down to the city; using gravity for public transport
- An emergency slide for evacuating a plane onto an inflatable raft
- A drone delivery capture system or spacecraft landing system

Design Thinking and Computational Thinking

The design thinking loop is particularly effective here with the **ideation** stage:

With limited materials available, there are fewer opportunities to iterate their prototype, and so much of their design must be undertaken imaginatively rather than practically. This also means they will be engaging in **internal modelling** and simulation component of **computational thinking** processes.

If you do run this activity multiple times, try using the alternative contexts for the task. Does the imagined purpose of their design affect how the participants work? They are engaging with the **empathy** and **definition** stages of design thinking without realising it. You can help them to understand this after the fact with group **evaluation**.

Bag-Tag-arama

S T E M

C D F S

Individual Team

Mess made	0 /10
Teacher involement	7 /10
Resources needed	3 /10

Required Resources Per student:

- Worksheet
- Instructions
- Computer with Internet access (Note – actually printing the tags increases the resource cost

Step it Up with:
Printing out their tag designs for them to keep, adding a more complex design task

Recharge with:
New worksheets

Task
There was a special at the shops on backpacks and everyone in your class has purchased the same one! Make yours unique by designing a 3D printed bag tag with your name on it using Computer Aided Design (CAD).

Preparation
To print with your own 3D printer, or go without printing the finished tags:
Prior to the lesson, create an educators Tinkercad account. Go to www.tinkercad.com and follow the prompts. This will allow you to create a classroom your students can join to create their bag tags. The account will allow you to monitor student progress and make minor design adjustments as needed.
If you do not have a 3D printer and would like us to print the tags for you:
Prior to the lesson, contact STEMIE@unisa.edu.au for us to set up an online classroom and give you log-in details for your students. The designs will only be accessible by UniSA staff and you will not be able to monitor student progress on their designs. Tags will be deli
to your school on completion. Printing may incur a fee, which we can discuss in advance.

Bag-Tag-arama

As this is about safety, the slowest time wins - 1st place 3 additional points, 2nd place 2 additional points, 3rd place 1 additional point.

Context/story alternatives:

- Designing tokens to swap for a meal at school as part of a ‘free lunch’ program
- Designing stakes to drive into the soil to identify where seeds have been planted
- Creating a bookmark with their name on it

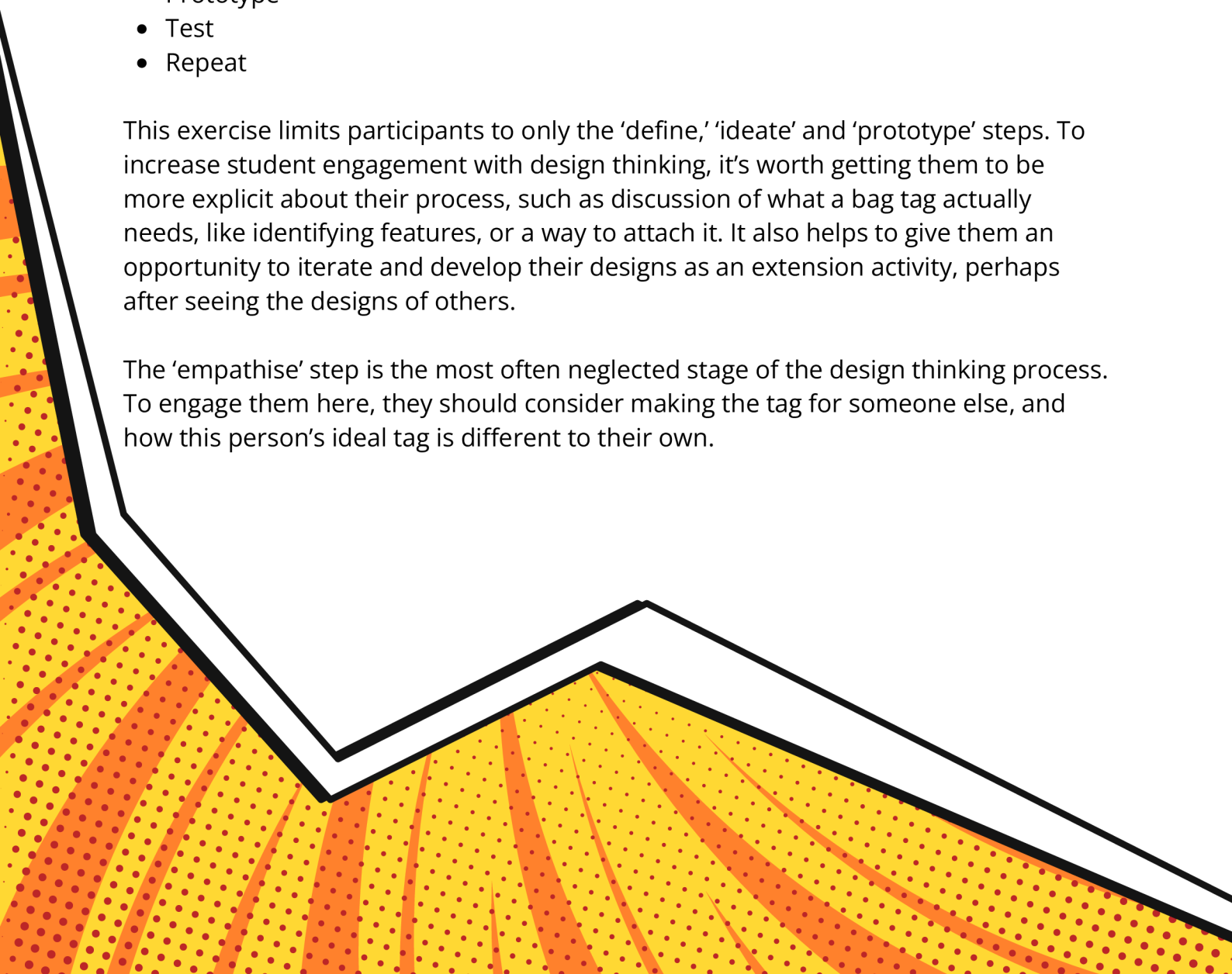
Design Thinking

Design thinking is a looping process of thinking that goes through the following steps:

- Empathise
- Define
- Ideate
- Prototype
- Test
- Repeat

This exercise limits participants to only the ‘define,’ ‘ideate’ and ‘prototype’ steps. To increase student engagement with design thinking, it’s worth getting them to be more explicit about their process, such as discussion of what a bag tag actually needs, like identifying features, or a way to attach it. It also helps to give them an opportunity to iterate and develop their designs as an extension activity, perhaps after seeing the designs of others.

The ‘empathise’ step is the most often neglected stage of the design thinking process. To engage them here, they should consider making the tag for someone else, and how this person’s ideal tag is different to their own.



Majority Rules

S T E M

C D F S

Individual Team

Mess made	0 /10
Teacher involement	6 /10
Resources needed	3 /10

Required Resources Per student:

- Worksheet
- Computer connected to the Internet

Step it Up with:

Real micro:bits. UniSA have class sets of micro:bits available for sale or hire. Email STEMIE@unisa.edu.au for more information

Task

National science week is Australia's annual celebration of science and technology which runs in August every year. Using technology your class needs to find a way to vote, should your class be involved in science week and set up a class display? You decide!

Go to makecode.microbit.org/ and select 'Create New Project'

Make the micro:bit light up with a tick when button A is pressed and a cross when button B is pressed

Context/story alternatives:

- School is making a digital display to represent its students. Choose two simple designs to represent yourself that can be switched between.
- We want to know how you are feeling. Make a display that can show whether you are happy or sad. Extend by adding more feelings.
- The voting system can also be repurposed for anything: civics issues, whether to dunk the headteacher in water at the school fair, get creative!

If you are interested in some of our coding courses contact us at STEMIE@unisa.edu.au for information.

Majority Rules

Design Thinking and Computational Thinking

Micro.bit programming is a great starting point for further activities. This activity can act as a tutorial of sorts that gets students quickly familiar with the tools but can then be easily extended with other challenges. The looser the requirements, the greater the opportunity for complex thinking during the exercise. As a first step in a short time frame, this activity is good, but extending it is what will allow the students to really push further into both computational and design thinking. Programming tasks like this are a great way to challenge learners to do both

Who Ate the Teacher's Lunch

S T E M

C D F S

Individual Team -Recommended group size 3

Mess made 8 /10

Teacher involement 6 /10

Resources needed 9 /10

Required Resources

- 1 or 2 class 3 number combination lockboxes containing a picture of a mouse

Per group:

- Worksheet
- 2 tsp Bicarb soda
- 10ml Water
- ¼ tsp Turmeric powder
- 5 ml Hand sanitizer
- Cotton tips for mixing and for writing
- 2 Small plastic medicine cups/shot cups

For the extension

- Variety of liquids to test pH, in small labelled medicine cups, e.g. milk, orange juice, lemon juice, dishwashing liquid, soap solution, baking soda solution, hand sanitizer.
- One small plastic medicine cups/shot cups per liquid being tested
- pH strips or cabbage indicator
- Optional - absorbent sheets (puppy training pads) to control staining and spills.

Recharge with:

more worksheets, replace ingrdients, pH strips/indicator, liquids for testing and cotton tips

Task

Civil engineers design structures, these include bridges, buildings and roller coasters. Today, you are the engineer. Can you design the end of a rollercoaster ride that brings riders safely back to the start?

- You can only use these materials supplied to make your rollercoaster
- The rollercoaster must begin 25cm from the ground and span (travel) 60 cm.
- Your rollercoaster must allow a ping pong ball to travel safely without stopping or falling off along the way and it needs to travel from one paper plate to finish on the second paper.

Who Ate the Teacher's Lunch

Rules
The roller coaster must be free standing, it must be a continuous track.
The landing plate cannot be modified in any way, and nothing can be stuck to it. The starting plate and paper can be modified.

Step it up with:
A more complex decoding stage to crack a code once the message is revealed

Accessibility Note:
Allergies or skin sensitivities may warrant non-latex gloves or replacing some of the testing liquids

Task
Lunches have been going missing in the staff room, in particular the cheese sandwiches, can you help solve this mystery? Find the code to unlock the security footage.

Predicting who the culprit is.
- You will need to make some invisible ink with baking soda and water, by mixing half a teaspoon of baking soda with a small amount of water until it is a paste.
- On one piece of paper write down your suspect using your invisible ink.
- Leave it to dry.

Solve the mystery
- Make a mixture of hand sanitiser and turmeric and use this to paint over the supplied code card. This will reveal three numbers.
- Use the table to create all the combinations that can be made from those three numbers, one combination will open the lock and reveal the security footage. What three numbers did you reveal on the mystery solving card?

Notes
Each class will need at least 1 (we recommend 2) locked box with a 3 digit number padlock. A toolbox works well, but a cheaper version would be a cardboard box with a rope chain through some holes securing the box shut using the padlock. Number combination padlocks can be purchased from hardware stores such as Bunnings
Pool pH strips are available in the supermarket or at Bunnings. 6-8 strips per group depending on how many household solutions you want to test.
Cabbage indicator can be made by boiling up red cabbage and adding some of the mixture to the solutions. The colour of the cabbage solution will change in the presence of acids or bases. Red, pink, purple are acidic colours, blue green yellow are basic colours.

Who Ate the Teacher's Lunch

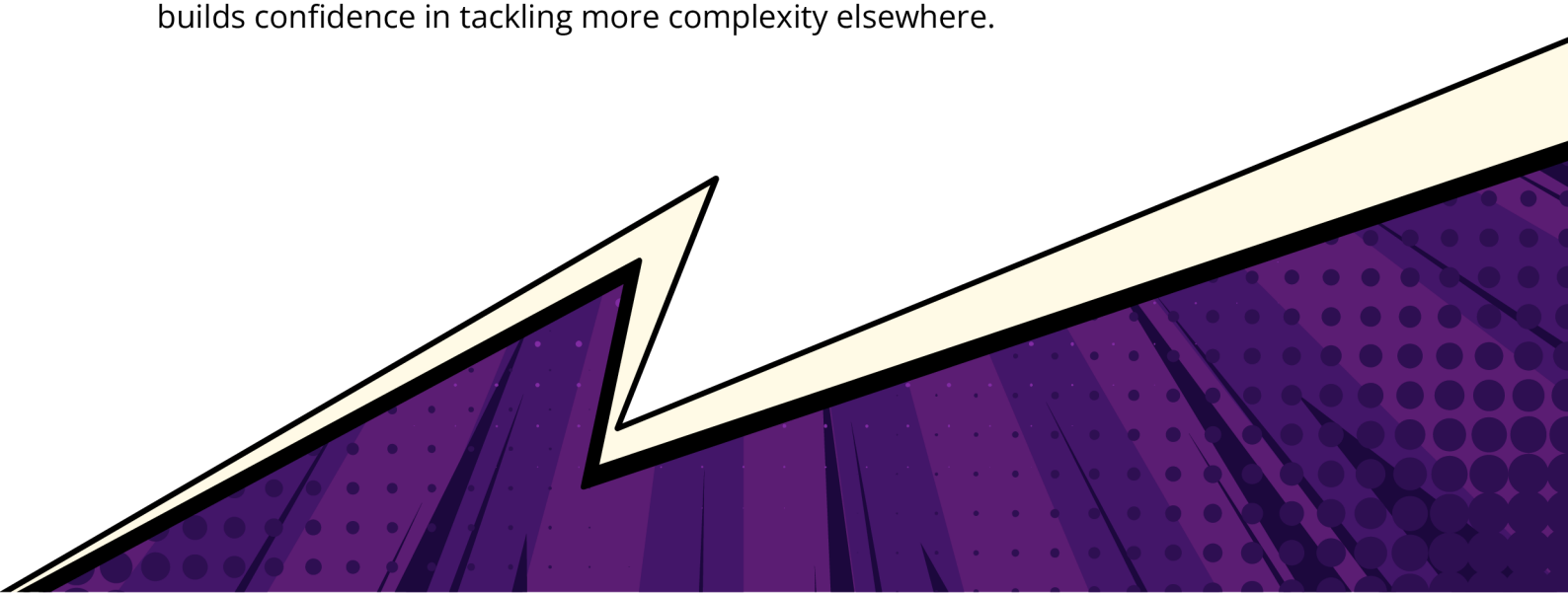
Preparation
This activity requires Code Cards to be made ahead of the day. Mark a piece of paper with the 3 digit padlock code numbers written on it with invisible ink (baking soda and water paste) and "?" visibly written on it, this is so students know which side of the paper to test. The three digits need to be correct numbers for the code but not in the correct sequence.
e.g. if the padlock code is 314, the code cards will have 431 or 341 etc. written on them using the bicarb and water paste.
Ensure you make the sets of materials ready to be distributed ahead of time.

On the day
First distribute the bicarb soda, water, turmeric, hand sanitiser, cotton tips and medicine cups to the groups
Only when the students have made their invisible ink, turmeric solutions and unlocked the security footage should the household solutions and pool strips (or cabbage indicator solution) be supplied to the groups.

Alternative contexts

- Espionage: The code to a safe has been smuggled out to you but you cannot read the message. Make the numbers appear and crack the code, before sending your own secret message
- Extra credit: Your science teacher has offered to give you extra points on your next test if you can solve their challenge and tell them what word is written inside the lockbox on their desk. Can you crack the clue and then send them the password in secret?
- Shame on you: Your teacher wrote down some important numbers, but their prankster friend gave them invisible ink to write with. Can you make it appear again and save your teacher from their embarrassment?
-

Computational Thinking is only really a part of the code finding process once the numbers are revealed. This activity is exciting for self-efficacy reasons more than complex thinking skills. Trusting students with messier, more complex activities builds confidence in tackling more complexity elsewhere.



Chemistry Chaos

S T E M

C D F S

Individual **Team** -Recommended group size 2-3

Mess made	2 /10
Teacher involement	6 /10
Resources needed	7 /10

Required Resources

- Worksheet,
- Chemistry model kits (borrow/buy from UniSA, buy/3D print yourself/borrow from a high school)

Recharge with:
New worksheets

Step it up with:
Other noteworthy organic molecules/hydrocarbons to make

The school has run out of hand sanitizer. You will need to make the active ingredient so more hand sanitizer can be made.

Task

- Select 2 Carbon (black) 1 Oxygen (red) and 6 Hydrogen (white) pieces and 8 grey connectors (all the same size)
- Join the pieces up so that all the holes on the pieces are filled with a connector and no connectors are left unjoined to another piece.
- There are two ways these same pieces can be joined together, find the one that has the least symmetry (less of a mirror image down the middle). This is the molecule in hand sanitizer.
- Once you have created this molecule (called ethanol) show the STEM Showdown umpire and try to draw your molecule on the next page

Notes
Schools can hire or buy 3D printed molecular model kits from The University of South Australia, or we can supply the .stl files to print your own. For details email STEMIE@unisa.edu.au

Extensions/alternatives:

Vitamin C
Students in New Zealand successfully proved the makers of Ribena were lying about the vitamin C contained in the drink, costing the company a huge fine:

https://www.theguardian.com/world/2007/mar/27/schoolsworldwide.foodanddrink

See if students can make L-ascorbic acid so they also know what Vitamin C looks like.

Photosynthesis puzzle
How do plants take carbon dioxide out of the atmosphere? Through photosynthesis. They make sugars from it, specifically glucose.

Have the students make a glucose molecule ($C_6H_{12}O_6$) and see how many molecules of carbon dioxide went into it. What else is needed to use up the carbon molecules? Can they see that oxygen is also created in this process, as they have to use more oxygen atoms than there are in the original molecule?

Combustion puzzle
The reverse of the above – burning a fuel creates carbon dioxide and water. Have the students make a simple molecule of a fuel, such as methane (CH_4) and see what they need to add to be able to make H_2O and CO_2. This demonstrates why fire requires oxygen.

Computational Thinking
The intention of the extensions and other contexts is to afford more opportunities for computational thinking. Students have to break down the problem further, and begin to consider the real world context in order to arrive at an answer. The context of the vitamin C story even allows for a little engagement in systems and futures thinking as they can observe the purpose of this knowledge and why it is personally relevant.

Don’t Bug Me - Mozzie Edition

S T E M

C D F S

Individual **Team** -Recommended group size 2-3

Mess made	0 /10
Teacher involement	3 /10
Resources needed	2 /10

Required Resources Per Team

- Worksheet,
- Mosquito ID Cards set

The school is joining a citizen science program where they catch mosquitoes and identify their species as part of a survey of mozzies all over Australia. You are going to practice your mozzie ID skills and see if you can spot the odd one out.

Task

Use the ID cards to identify the mosquitoes on each of the “Field Observation” cards and write the numbers in the correct place on the worksheet. Your teacher will circle any that are wrong for your team to try again until they are all correct.

Bonus

One of the mosquitoes is “invasive” and has been found outside of where it would normally find. Can you tell which is which

Extension

Students will need page 4 of this worksheet for the extension activity.

Mess made	4 /10
Teacher involement	5 /10
Resources needed	5 /10

Don’t Bug Me - Mozzie Edition

Equipment

- A piece of polystyrene foam (just larger than the specimen being pinned)
- Tiny piece of polystyrene or plasticine for propping the specimen up off the foam
- Pins (plain thin metal pins, no thumb tacks etc)
- Specimens (large crickets are available from most pet shops, or you can catch your own specimens)
- Optional - binocular microscope for viewing the bugs

Setup

We recommend laminating the ID cards for use with multiple classes.

We do not recommend getting students to collect their own specimens in case they get bitten in the process.

Specimens for the extension task should be killed by placing in the freezer a couple of days prior.

On the day, to speed up the extension task distribution, pre pin some specimens to pieces of foam with the central pin through the abdomen and propped up on plasticine or a small piece of polystyrene.

Notes

The crickets may have some movement on the foam due to a build up of static electricity.

We recommend counting out the pins to each student and getting them to check they use or return them all to reduce the chance of pins falling on the floor especially in a carpeted classroom.

Digital microscopes are an amazing addition to this task, enabling students to get a very close and detailed look at the insects. The microscopes have a screen for easy viewing and work well in groups, they can also be plugged in to a computer and displayed on a smart board for an entire class to see. Here is a link If you were interested in purchasing digital microscopes similar to the ones we bring in the university run sessions.

https://www.kentfaith.com.au/microscope/GW45.0035_4.3%22-lcd-digital-microscope-50x-1000x-magnification-adult-kids-usb-microscope-with-8-adjustable-led-lights-compatible-with-windows-mac-ios

Computational Thinking

This is primarily a pattern recognition exercise, looking for the markings and features of mosquitoes in the photographs as well as linking those to location. The invasive species question allows the students to evaluate things a little further and add context: no simple key will be perfect, and they must be able to recognise and understand exceptions.

Don't Bug Me

S T E M

C D F S

Individual **Team** -Recommended group size 2-3

Mess made 1/10

Teacher involement 4/10

Resources needed 4/10

Required Resources Per Team

- Worksheet,
- Some plastic animals (1 set for class from KMart)
- Classification chart
- (Animal scientific names chart (optional))

Recharge With

New worksheets

Step it up with

More animal sets to give everyone more option

Life on Earth is so varied! Everything is different, but some also look very alike. Can you identify the creatures scattered on the floor? And which are new species for you to discover?

Task

- Choose an animal
- Use the ID chart supplied to determine the common name of the animal. This diagram may help when using the identification chart.
- Find an animal not described on the classification chart. Identify which animal on the chart you could most easily mistake it for and then draw a picture of the new species.

Extension

Students will need page 4 of this worksheet for the extension activity.

Mess made 3/10

Teacher involement 5/10

Resources needed 5/10

Don't Bug Me

Equipment

- A piece of polystyrene foam (just larger than the specimen being pinned)
- Tiny piece of polystyrene or plasticine for propping the specimen up off the foam
- Pins (plain thin metal pins, no thumb tacks etc)
- Specimens (large crickets are available from most pet shops, or you can catch your own specimens)
- Optional - binocular microscope for viewing the bug

Setup

We recommend laminating copies of the classification key for multiple classes.

We do not recommend getting students to collect their own specimens in case they are bitten in the process.

Specimens for the extension task should be killed by placing in the freezer a couple of days prior.
On the day, to speed up the extension task distribution, pre pin some specimens to pieces of foam with the central pin through the abdomen and propped up on plasticine or a small piece of polystyrene.

Notes

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Context story alternatives

- Island discovery – a new island has been found. Some creatures match animals we have seen on the mainland, but some are unique to this island. Can you work out which?
- Ranger training – you need to be able to ID poisonous and rare creatures before you take a tour group into the bush. Practice your ID skills and be bush ready.
- Toy science – K-Mart has released this set of toy animals, but some of them aren't real. In order to use them in a lesson, we need you to work out which are real, and which are made up.

Don’t Bug Me

Context story alternatives

- Island discovery – a new island has been found. Some creatures match animals we have seen on the mainland, but some are unique to this island. Can you work out which?
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- Toy science – K-Mart has released this set of toy animals, but some of them aren’t real. In order to use them in a lesson, we need you to work out which are real, and which are made up.

Computational Thinking

This is a classification exercise, using the key to follow an algorithm to ID the animals. Identifying creatures outside the key helps them to understand the design of the algorithm and consider how it was designed. Drawing an animal after using the classification key will have prepared them for which elements to focus on in their illustration to highlight its unique features.

Tie Breakers

In the event of a tie for Championship Points, the winner can be decided in a tie breaker activity.
These activities would have a short time limit, and while the entire class may attempt the task only those students in the lead are eligible to win.

Some suggestions are

S - Computational Thinking - The clearest steps for the task in the 5 minute time limit wins. (written or described

T - Circuit Diagrams - Whoever finds the most components in the 5 minute time limit wins. (pattern recognition search)

E - Civil Engineering Tower Challenge - 10 minute time limit to plan and build, tallest tower wins.

M - Maths Puzzle - First to solve the sequence wins.
(Fox, Goose, Corn)