STEAM ideas for your classroom

Cristy Burne

Be brave

For me, STEAM education is all about discovery, curiosity, problem-solving and hard fun. There's no correct way to do it. Mistakes will be made. Mess will be made. Hair will be torn out.

But a way forward will be found.

Because students who are driven by their curiosity and their sense of achievement are learning big-time. They're learning to be self-motivated and to be resilient. They're learning teamwork, initiative, self-regulation and more. Learning all this isn't easy. Even as adults, we're still learning how to be good humans.

But if we can provide opportunities for our young people to practice these skills, wow! What a difference that can make … in the classroom, and in the real world.

For me, STEAM investigations work best when they mirror real-life. That means there are no right answers or perfect solutions. Many students will struggle with this. *I* struggle with this every day. I wish there was a perfect way to write a book, or a correct way to be a parent. But there isn't. There's only try, learn from mistakes, and try again.

The science experiments below are simple, fun, (relatively) easy to clean up (😉) and can be extended into STEAM investigations and projects. I've linked these activities to my books, in case you're studying them in class and want to try integrating a bunch of ideas across the curriculum…. But these are only suggestions. Teachers are a wildly creative bunch, and I feel sure you'll have loads of new and awesome ideas.

I hope these notes spark some ideas for you and your classroom. If they're useful, or if you have feedback to make them better, please let me know (cj@cristyburne.com). Like everything, they're a work-in-progress.

Thanks for all you do for our young people and our shared future,

Ages 6-10
Outdoor adventure
Themes of resilience, survival, family and friendship

Beneath The Trees
(ages 6 – 10)

Written by Cristy Burne
Illustrated by Amanda Burnett
Published by Fremantle Press, 1 Feb 2021
ISBN: 9781760990411 (paperback)

About the book

Cam and Sophie want to see a platypus in the wild. But with the rain tipping down and the river turning wild, they can't see a thing. Until suddenly, they can. A platypus is just below them and it needs help! But when their rescue attempt goes horribly wrong, it's not just the platypus that needs saving.

Teaching notes

Classroom ideas linked to the curriculum

Take the platy-quiz

How much do you know *about platypus*?

Platypus bookmark

Make this bookmark for some mindful fun … and use it for reading your favourite story!

STEAM project brainstorm

- *Investigate features of the platypus*
- *Plan for an outdoor survival adventure*
- *Design an artificial rainforest ecosystem*
- *Experiment with ways to improve your balance on a pretend log-crossing*
- *Propose a program to encourage conservation of platypus habitat*
- *Re-imagine the story from the point of view of a leech*
- *Build a model riverbed to demonstrate flash flooding*

STEAM investigation idea: IMPOSSI-BRIDGE

In *Beneath the Trees*, Cam, Sophie and Jack desperately need to cross a raging river. But there is no bridge …

Enquiry question: Could you create a sturdy bridge using just sheets of paper?

Students experiment with different ways to create a load-bearing bridge out of paper.

Each group will need:

- Two or three sheets of A4 paper
- Two bridge props (like cans or cups)
- Two or three weights (like mandarins or toy cars)

Investigate:

Are there ways you can use the paper to make a bridge that can a) span the two props and b) hold up a weight?

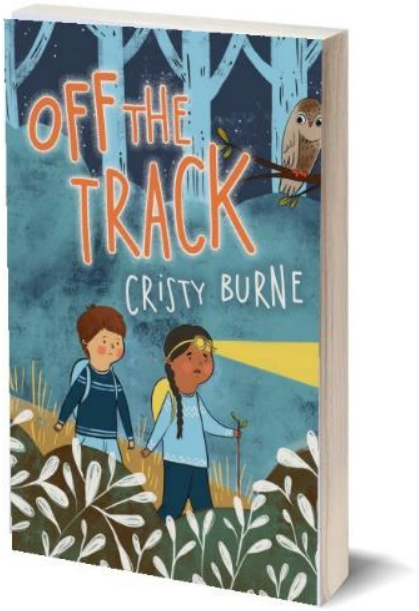
Spoiler alert-> There are at least a couple of methods that may work well here: corrugation (forming triangular bends or rolling a tube (both methods work to distribute the load).

Things to maybe discuss before you start:

What are some of the shapes you see in buildings and bridges? What shapes are strong? What shapes are not strong?

Extension ideas:

- **Re-writing:** Rewrite the end of the book to include a scene where Cam, Sophie and Jack work together to create a bridge. What happens next?
- **Write a shape poem** that describes the strength of different shapes…and write it in the shapes you are describing.
- **Design and label a new sort of rocket ship**, pointing out the shapes you have used to make it strong.



Ages 6-10
Outdoor adventure
Shortlisted for WAYRBA and Environmental Award for Children's Literature

Off The Track
(ages 6-10)

Written by Cristy Burne
Illustrated by Amanda Burnett
Published by Fremantle Press, July 2018
ISBN: 9781925591743 (paperback)

Shortlisted: 2019 Wilderness Society Environmental Award for Children's Literature

Shortlisted: 2021 West Australian Young Readers' Book Awards

About the book

A new adventure for young readers about falling in love with the bush and being in the wild. It's about disconnecting from technology. And discovering yourself. *Off The Track* celebrates the Australian bush and the time-honoured tradition of a family hiking adventure.

Teaching notes

Classroom ideas linked to the curriculum

Make your own survival whistle

Annoying – and it could *maybe save your life*!

STEAM project brainstorm

- *Design and map out a new long-distance hike you'd like to do*
- *Construct your own survival shelter*
- *Plan what to pack to survive overnight in the bush…on a $100 budget*
- *Teach your friends how to cook a favourite camp food recipe*
- *Research science experiments that use marshmallows*
- *Build a model gum tree using only marshmallows and toothpicks*
- *Write your own camping-related joke book*

STEAM investigation idea: SURVIVAL WHISTLE

In *Off The Track,* Deepika teaches Harry how to make a whistle using a gum leaf. Want to make your own survival whistle?

Enquiry question: Can you harness the science of sound to make a musical whistle?

Students can experiment with different ways to make the loudest noise. What's the smallest paper whistle you can create? Does size influence volume or pitch?

You will need: Paper

Investigate:

Students attempt to make and play a variety of paper whistle designs.

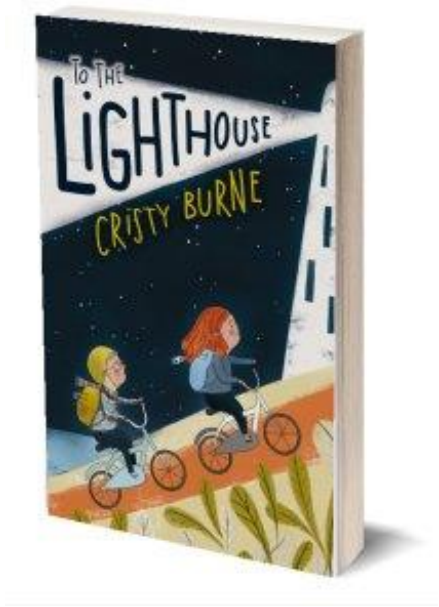
Things to maybe discuss before you start:

What are some other musical instruments? How do they work? How do wind instruments work?

- *Spoiler alert -> VIBRATIONS: Wind instruments work because the air you blow through the instrument causes a vibration. Your brain interprets these vibrations as sound.*

Extension ideas:

- **Experiment some more**: Can you design a musical instrument that lets you play notes of a different pitch? What is *pitch* anyway? Why do you think large instruments, like the tuba, make such a low-pitched sound? And why do smaller instruments, like the piccolo, make a higher pitched sound?
- **Destructive vibrations**: Have you heard that an opera singer can smash glass by singing a single note? Is this truth or myth? How could it be possible?
- **Use your whistle to survive!** Imagine a scene where you could use a paper whistle to survive or escape. Create a graphic novel showing what happens…
- **Write and perform a short rap** about what you have learned about sound. Can you perform it using a homemade musical instrument?



To the Lighthouse
(ages 6-10)

Written by Cristy Burne
Illustrated by Amanda Burnett
Published by Fremantle Press, June 2017
ISBN: 9781925164619 (paperback)

Shortlisted: 2019 West Australian Young Readers' Book Awards

About the book:

Isaac arrives on Rottnest Island hoping for an awesome holiday adventure, but his mum would rather he stayed inside, where it's safe.

Ages 6-10
Rottnest Island adventure
Shortlisted for WAYRBA
Themes of friendship, honesty and courage

Then Isaac meets Emmy. She's allowed to do whatever she wants – and she wants to have fun!

With Emmy daring him on, Isaac's life gets more and more exciting. But when things go horribly wrong on their secret midnight adventure, they both wonder whether this time they've gone too far…

Teaching notes

Classroom ideas linked to the curriculum

Design your own holiday adventure

What would your perfect island adventure include?

Activity workbook

Loads of fun activities to try at home or in the classroom.

STEAM project brainstorm

- *Build your own model lighthouse – complete with working light*
- *Draw and label a futuristic designer lighthouse-with-everything*
- *Learn more about quokkas and how to protect them*
- *Design your own private island lifestyle, complete with all you need to live*
- *Create an artwork that expresses how you feel about Rottnest Island*
- *Experiment with the relationship between salt and water, ice, temperature and/or floating.*
- *Plan and budget for a school camp at Rottnest Island*

STEAM investigation idea: PAPERCLIP CHALLENGE

During their holiday in *To The Lighthouse*, Emmy and Isaac count the number of steps they need to climb to reach the top of the lighthouse.

In this experiment, you'll count the number of paperclips needed to reach the top of the container. And you might just get a surprise!

Enquiry question: How many paperclips can you add to a mostly full bottle before it overflows?

Each group will need:

- Packet of paperclips
- One empty Yakult bottle, about 7/8th filled with water
- A hypothesis: how many do you think will fit before it overflows?

Investigate: Carefully add one paperclip to the bottle and think about what you see. Now add another. And another. Count how many you are adding. What is happening?

Things to maybe discuss before you start: What do you know about water? What shape is a droplet of water? Do you think paperclips can float on water? Have you seen insects walk on water? How is that possible?

SPOILER ALERT -> Water should bulge above the level of the bottle before finally overflowing. This is because of surface tension. Surface tension is a force that draws water molecules close together.

Extension ideas:

- **Change it up:** Change one thing in this experiment and try it again. What did you change? What do you think will happen? *(Ideas include dropping a bit of detergent into the water; using very cold water; using milk instead of water)*
- **Write a haiku poem** to describe the moment just before the bottle overflows, or the way water molecules stick together so tightly.
- **Life or death…** Write a scene where your life depends on guessing the right number of paperclips. Include loads of tension. Make me sweat with fear…

Ages 8-12
Fantasy adventure
CBCA Notable Book 2022

Wednesday Weeks series (ages 8 – 12)

In a world of magic,
can science save the day?

Wednesday Weeks and the Tower of Shadows ISBN: 9780734420206 *(April 2021)*

Wednesday Weeks and the Crown of Destiny ISBN: 9780734420213 *(September 2021)*

Wednesday Weeks and the Dungeon of Fire ISBN: 9780734420237 *(August 2022)*

Co-created by Denis Knight and Cristy Burne

2022 CBCA Notable Book, Book of the Year Awards

About the series:

Wednesday Weeks never wanted to be a sorcerer's apprentice. She'd rather study science than magic. But when her cloak-wearing, staff-wielding grandpa is captured by a power-hungry goblin king, Wednesday must find a way to embrace her magical heritage and rescue him from the dreaded Tower of Shadows.

Teaching notes

Classroom ideas linked to the curriculum. There are also science activities in the back of each book.

Read an excerpt

Get started on your Wednesday Weeks adventure…

STEAM project brainstorm

- *Keep silkworms*
- *Experiment with purple cabbage indicator*
- *Propose an alternative to the Large Hadron Collider*
- *Design an automatic pizza train*
- *Invent your own Nine Realms, complete with culture, biology, geography and more*
- *Write a book of Science Spells for Beginners*
- *Create a game using magnetism*

STEAM investigation idea: OPPOSITES ATTRACT

Have you ever noticed how Alfie from the *Wednesday Weeks* series has such gravity-defying hair? Want to know his electrifying secret?

Enquiry question: Can you use static electricity to style your hair? What else can you do with static electricity?

Students play with the effects of static electricity.

You will need:

- Balloons (large and water-balloon-sized)
- Plastic combs
- Empty aluminium cans
- Your sleeve
- Your hair
- A wall
- A stream of water from the tap
- A plastic ruler
- Scraps of paper or plastic bag

Investigate:

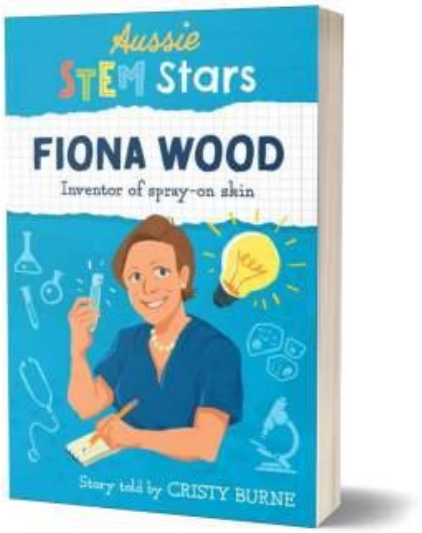
SPOILER ALERT-> Static electricity results when positive or negative charges build up on an object. You create static electricity by rubbing two objects together; that contact causes negatively charged electrons to move from one object to another. For example, rubbing the balloon on your jumper transfers electrons from the jumper to the balloon, leaving the balloon negatively charged. Since opposites attract, the negatively charged balloon attracts the positively charged hair.

Things to maybe discuss before you start:

What do you know about static electricity? What kind of things can static electricity do?

Extension activities:

- **Write a story** involving your own build-up of static electricity. Is it funny? Is it scary?
- **Wave those wings:** Draw your own fantastical flying animal. Use what you've learned to glue on wings and make them move.
- **The Static Games:** What's the largest bit of paper you can lift using static electricity? Who will win this new Olympic Sport?



Aussie STEM Stars – Fiona Wood: Inventor of spray-on skin (ages 10+)

Written by Cristy Burne
Published by Wild Dingo Press, 1 September 2020
ISBN: 9781925893281 (paperback)

– SHORTLISTED 2021 Speech Pathology Australia Book of the Year Awards

– SHORTLISTED 2020 Australian Book Design Awards

About the book:

An authorised biography of burns surgeon, inventor and Australian of the Year Professor Fiona Wood, written especially for ages 10+. An inspiring true story of spirit and stamina, generosity and courage. Narrative non-fiction.

Teaching notes

Classroom ideas linked to the curriculum

Check out the other Aussie STEM Stars

There's a *whole series*. Which hero are you?

For those who want to draw…

Can you take *the Aussie STEM Stars illustration challenge*?

STEAM project brainstorm

- *Research and write about your own Aussie STEM Star*
- *Propose your own life-saving invention and write a speech to get it funded*
- *Create a quiz to help your friends decide on a career*
- *Recreate Fiona's story as a pop-up book*
- *Design a demonstration that shows why running water is good first aid for a burn*
- *Post a letter to Wild Dingo Books, the publisher of Aussie STEM Stars, persuading them to write their next book about you.*
- *Build a 3D model depicting a scene from the book*

STEAM investigation idea #1: D.I.Y FIRE EXTINGUISHER

Dr Fiona Wood has dedicated her life to improving outcomes for burns patients – and to reducing how many people get burned. How much do you know about first aid for burns? What about fire and fire safety?

Enquiry question: How can you put out a candle?

Students suggest ways to put out the candle; teacher carries out investigation. What do they think will happen? Why do they think it happens? Are there any patterns?

You will need:

- A candle and lighter
- A bunch of things to try, like hairdryers, balloons, a glass, a water balloon….

Investigate:

Spoiler alerts -> You can try to put out the fire by removing:

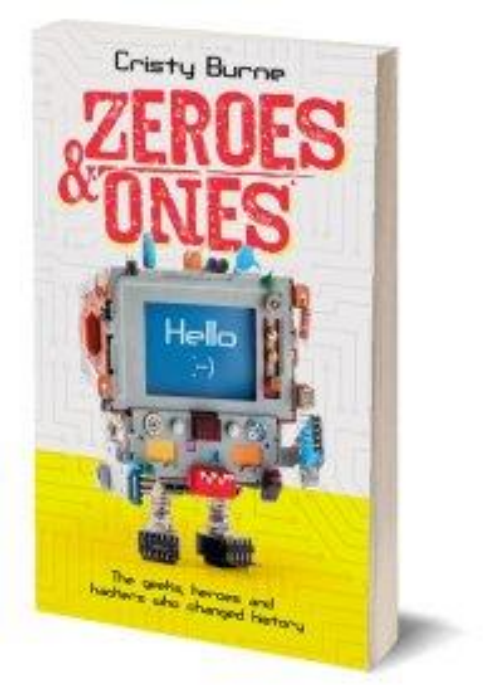
- *OXYGEN: Smother the flame using a drinking glass, a fire blanket, or a jug in which you have reacted bicarb and vinegar (to make CO_2)*
- *FUEL: Displacing the vapourised candle wax by blowing it away with a hairdryer or a balloon*
- *HEAT ENERGY: Take the energy out of the fire using water or just a filled water balloon*

Things to maybe discuss before you start:

What are some of the safety rules when dealing with fire? What types of fire do you see around the house and elsewhere? What are some ways to put out a fire?

Extension ideas:

- **Journal writing**: How do you feel about fire? Write about a time when you remember or imagine a fire.
- **Design a poster** outlining classroom safety rules when dealing with fire.
- **Write an advertisement** for a new kind of fire extinguisher you have recently invented. Remember: it must work by removing either fuel, oxygen or heat from the fire.
- **Burns first aid:** Research what to do if you or someone near you is burned. What is the best first aid response in an emergency?



Zeroes and Ones: The geeks, heroes and hackers who changed history (ages 8+)

Written by Cristy Burne
Published by Brio Books, August 2018
ISBN: 9781925589399 (paperback)

Notable Book, 2019 Children's Book Council of Australia

Shortlist 2019 Speech Pathology Australia Book of the Year Awards

About the book:
Weird facts and funny stories about the invention of computers. This is a non-fiction book about the history of computing. It's a great book for kids who love facts.

Teaching notes

Classroom ideas linked to the curriculum

Computers and codes

These terrific booklets are available from the WA Department of Education website.
Download the *Computers and Codes* booklet and the *Computers and Codes Home Tutor guide*.

STEAM project brainstorm

- *Code your own computer game*
- *Create resumes for your Dream Team in your tech startup*
- *Invent a super-computer (complete with cool acronym) to solve a specific problem*
- *'Program' your partner to make a sandwich or navigate a maze*
- *Make a robot out of recyclables*
- *Send a letter from the future explaining what high-tech life now looks like*
- *Film a video introducing Planet Earth and your classroom to aliens*

The Cosmic Adventures of Alice and Bob (all ages)

Created by Aśka and Cristy Burne
ISBN: 978-0-646-80493-4 (e-book)

SHORTLISTED: 2018 Australian Book Design Awards

Find online: *Download the PDF*

About the book…

A graphic novel about dedication, daring and discovery…

Ever wanted to find the answer to BIG questions? Or dreamed of inventing the Next Big Thing?

The Universe is an amazing place, and we're only beginning to understand it. There's still so much to be discovered…

Teaching notes

Classroom ideas linked to the curriculum

Can you spot these space-boosted technologies?

A challenge to complement the book

STEAM project brainstorm

- *Learn more about the Square Kilometre Array*
- *Create your own graphic novel*
- *Design your own time machine then build it out of LEGO*
- *List ten things you'd love to discover about the universe*
- *Invent an alien code and use it to send a message*
- *Research all we know about life on other planets*
- *Draw a spot-the-difference picture of life in two parallel universes*

Want to give feedback or suggest an idea?

Please get in touch: cj@cristyburne.com