Introduction to STEM

Catherine Newington, ACS

Acknowledgement of Country

We acknowledge the traditional owners of the land upon which we meet. We pay our respects to their Elders past, present and emerging, and to all Aboriginal Elders from other communities who may be in attendance today.

Welcome to ACS

Powering Australia's technology brilliance

Australia's success increasingly depends on technology. It powers the delivery of government services, enhances children's learning and enables all businesses to innovate and improve productivity.

As the professional association and trusted leader in the tech sector, we bring together technology professionals from across business, government and education and equip them with the right skills and knowledge to power Australia now and in the future.

Career

Connecting tech professionals to the opportunities, pathways and skills to get ahead

We create career pathways to guide technology professionals and ensure Australia has a pipeline of talent with the right skills and knowledge
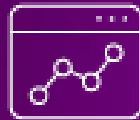
ICT Educators Program

We Support primary school and secondary school teachers to implement the Digital Technologies Curriculum.

Creating resources and providing professional development for teachers. We recognise the numerous curricula used across Australia.

Our program is flexible and grows as the needs of teachers and schools change too.
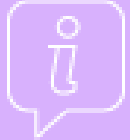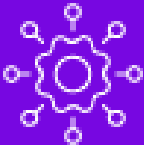
Catherine Newington

I spent 12 years as a Primary School teacher and a Technology and Learning Lead role for 5 years. Was a relief teacher for 3 years too.

I lead the ACS ICT Educators national program to support the implementation of the Digital Technologies Curriculum across Australia. I provide support for teachers to help plan and prepare their classes.

I am the co-vice president of the Victoria subject association for Victoria, DLTV.

Agenda

Defining STEM & Understanding the role of Pedagogy

STEM in Schools

STEM in an Hour

STEM Programs and Resources

STEM

S	**T**	**E**	**M**
Science	**Technology**	**Engineering**	**Mathematics**
To emphasise the wonders and our world	To emphasise the creation of tools to make our lives easier. Technologies and digital technologies	To emphasise the building and designing	To emphasise the mathematical skills and concepts

STEM

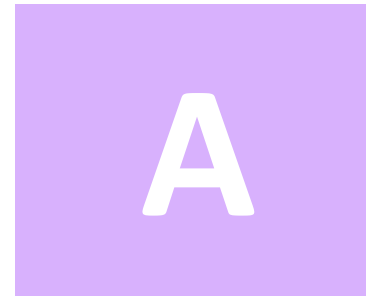| S	T	E	A	M

Science   **Technology**   **Engineering**   **Arts**   **Mathematics**

To emphasize the creative thinking and doing

From an Industry Perspective

75% of new jobs will require STEM skills.

The number of school students studying STEM in later secondary (Year 11 and 12) has flat-lined at around 10% or less.

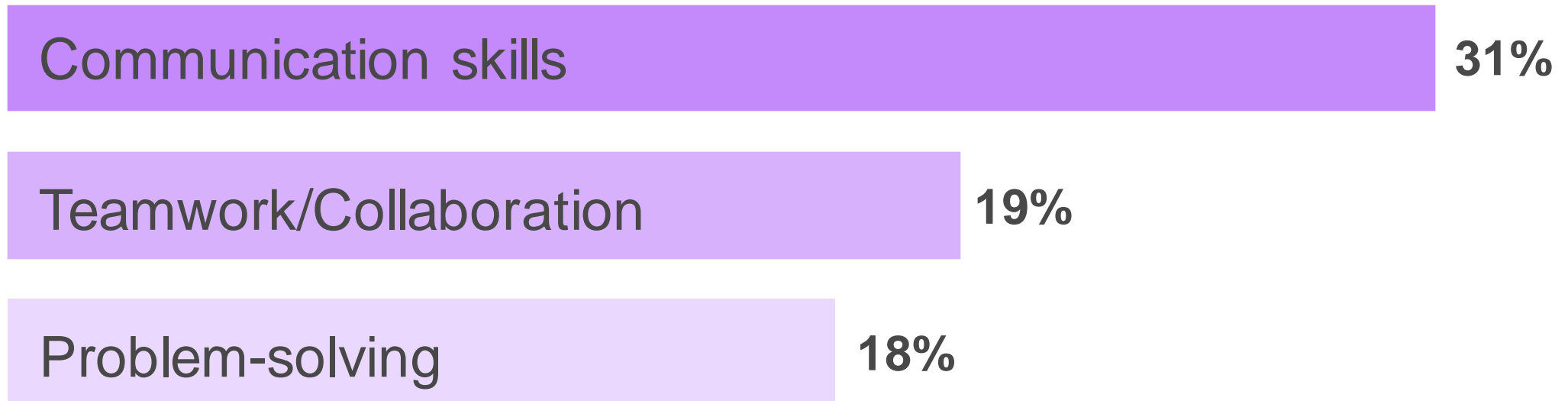90% will require digital skills in the next 2 – 5 years.

Australian students don't understand the importance of STEM, or STEM career opportunities, until it's too late.

From an Industry Perspective

The top 3 skills requested for all ICT posting in 2021:

Communication skills **31%**

Teamwork/Collaboration **19%**

Problem-solving **18%**

More than the Acronym

It's more than teaching the subject content.

It's about making connections. Between the skills, students and how they can bet transferred and the purpose of the learning.
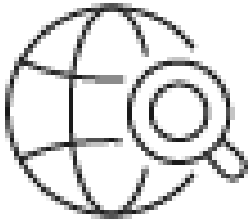
Putting knowledge into practical applications to understand the purpose of student learning.

Creating a space for students learn and become inquisitive about the world around them.

Pedagogy

Underpinning STEM is also underpinning inquiry and investigative style of learning. The pedagogy used in the classroom will support the skills needed in a STEM class.

Let's look at pedagogy – what is it? What does it look like in a classroom and how can you adapt it as a relief teacher.

Constructivism

What is Constructivism?

Constructivism is a learning theory that posits that individuals actively construct their understanding of the world by building upon their existing knowledge and experiences. It emphasizes the importance of hands-on, experiential learning and the role of social interaction in shaping one's learning and knowledge acquisition.

What does it mean for the students?

Enriches student learning by emphasizing active engagement and the building of knowledge through personal experiences and prior understanding. It encourages students to construct their own understanding of concepts, promoting critical thinking, problem-solving, and a deeper grasp of the material.

Where can I find resources on constructivism?

https://www.simplypsychology.org/constructivism.html

https://www.structural-learning.com/post/embracing-the-learning-theory-constructivism

https://teche.mq.edu.au/2022/06/abcs-of-pedagogy-c-is-for-constructivism/

Using this in the Classroom

Preplanning and find different resources to help them.

Ask question to simulate discussions beyond the topic. End of session reflection.

Allow students to construct their own knowledge and learning.

Provide them with learning material. Start small. Allow students to choose between 2 topics.

Inquiry Based Learning

What is Inquiry Learning?

Inquiry-based learning is a pedagogical approach that encourages students to actively explore and investigate topics by posing questions, conducting research, and seeking answers through critical thinking and problem-solving. It places a strong emphasis on student autonomy and the development of skills such as research, analysis, and self-directed learning.

What does it mean for the students?

Enhances student learning by promoting active exploration and investigation. It encourages students to ask questions, conduct research, and engage in critical thinking, fostering a deeper understanding of topics and the development of essential problem-solving skills.

Where can I find resources on inquiry based learning?

https://www.education.gov.au/australian-curriculum/national-stem-education-resources-toolkit/i-want-know-about-stem-education/what-works-best-when-teaching-stem/inquiry-based-learning

https://www.prodigygame.com/main-en/blog/inquiry-based-learning-definition-benefits-strategies/

Using this in the Classroom

Allow students to ask question to drive their investigation.

Set the scene on a topic and initiate conversation and discussions with students.

Time and focus is collecting and gathering information on a range of topics.

Graphic organisers and charts can be used to structure and plan their learning. Examples include: P M I (plus minus interesting) or K W L (know wonder learn) charts.

Project Based Learning

What is Project Based Learning?

Project-based learning is an educational approach that centers on students completing extended, hands-on projects to delve deeply into a particular subject or topic. It emphasizes active learning, problem-solving, and collaboration, allowing students to apply their knowledge and skills in a real-world context while fostering a deeper understanding of the material.

What does it mean for the students?

Project-based learning enriches student learning by providing hands-on, real-world experiences that allow students to apply their knowledge and skills in practical contexts. It fosters deeper understanding, critical thinking, and collaboration as students work on meaningful projects, preparing them for the complexities and challenges of the modern world.

Where can I find resources on project based learning?

https://www.bu.edu/ctl/guides/project-based-learning/

https://www.pblworks.org/what-is-pbl

https://education.nsw.gov.au/teaching-and-learning/curriculum/stem/early-stage-1-to-stage-3/project-based-learning-and-design-thinking

Using this in the Classroom

Opened end tasks to complete – be over 1 session with the students or a whole term.

Tasks that need multiple answers and knowledge development. Students use multiple skills and knowledge to obtain answers.

Encourage collaboration and working towards solving problems in small groups or as a class.

Graphic organisers can be used to structure and plan their learning. Example includes: staircase graphic organizer.

Deep Learning

What is Deep Learning?

Deep learning, focuses on fostering a profound understanding of content and encouraging students to apply their knowledge in meaningful ways. It includes the 6 Cs - Critical Thinking, Communication, Collaboration, Creativity, Character and Citizenship. They are considered important for preparing individuals to thrive in the 21st century.

What does it mean for the students?

The focus is fostering a holistic and future-ready approach. It enables them to engage deeply with the material, become adaptable learners, and prepare for success in a rapidly evolving world.

Where can I find resources on Deep Learning?

https://deep-learning.global/

https://www.aisnsw.edu.au/teachers-and-staff/teaching-and-learning/designing-for-deep-learning

https://www.edtechreview.in/trends-insights/trends/strategies-for-achieving-deep-learning-in-classroom/

Using this in the Classroom

Technology as a catalyst to bring together other areas of the curriculum.

Creating projects and lessons and that bring students together, to collaborate to achieve a common goal.

The application of real-world stories and build authentic learning opportunities for students.

Promote questioning and student inquiry.

Building STEM Learning

Encouraging questioning from students. Reducing the fear of failure and focus on is on exploring and learning not right or wrong.

Representing student learning through graphing. Students seek to find patterns and connections. Different visual representations.

Build their vocabulary. Learning new words and emphasizing the correct words.

Create a collaborative learning space. Students share ideas and learnings. Throughout the lesson not just saving it to the end.

For more strategies:
https://primaryconnections.org.au/resources-and-pedagogies/strategies

Technology

How can we use technology in the classroom to support STEM learning.

Use technology to build the learning such as robotics.

Spaces to learn and collaborate. Online collaboration tools to record their knowledge and learnings for student learning.

Find technologies that allow for student knowledge growth. Information on the topic. Virtual libraries.

TPACK

TPACK is a way of describing how technology pedagogy and content fit together to enable powerful learning.

The TPACK model highlights that an idea for using ICT in classrooms must have a sound curriculum and pedagogical fit.

Image from http://tpack.org

For more information:
http://tpack.org

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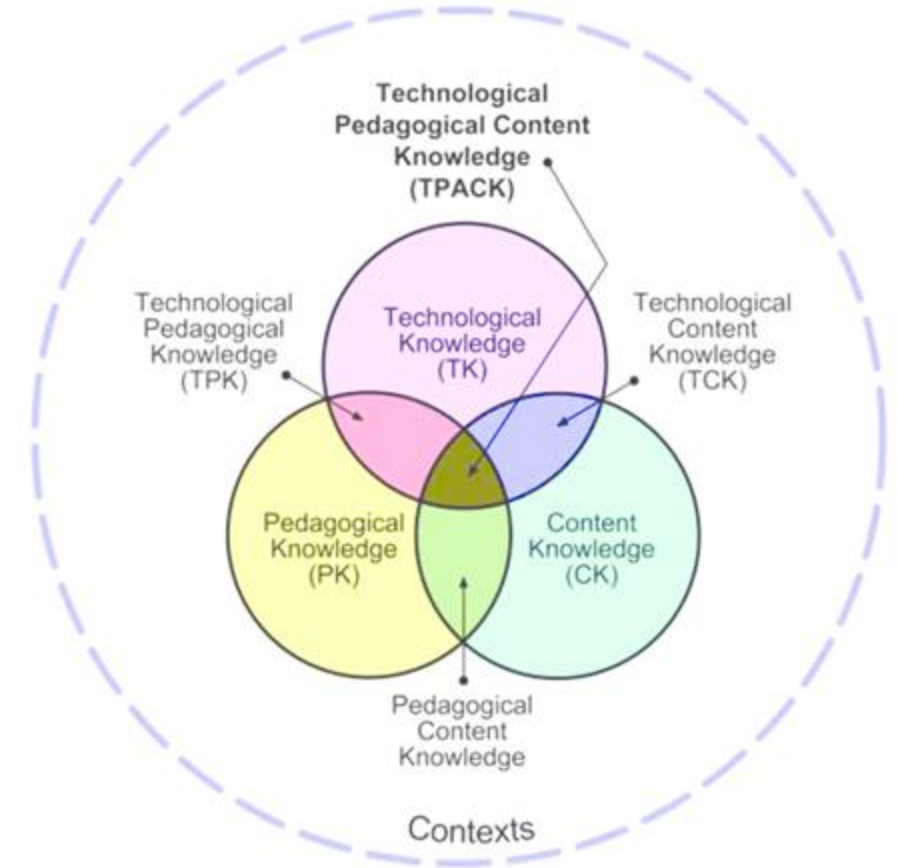
TPACK

Ensuring the technology that is chosen aligns to the curriculum.

Articulate your pedagogy and ensure the technologies marries to your teaching styles.

The students are engaging in the learning not just using technology

Understanding the pros and cons of technology to ensure it is best utilized in the classroom.

Emphasising the T

Love technology My passion – consider what your passion is

Look at potentials and power of technology in society and bring that into the classroom

Using real life stories of technologies to make learning authentic for students

From a curriculum perspective – Digital Technologies Curriculum focuses on students evaluating existing digital solutions

Emphasising the T

Block by Block

Summary

Block by Block is a nonprofit organization that uses Minecraft as a tool to help people in the community have a voice on how to design and shape community spaces.

More information

https://www.blockbyblock.org

Emphasising the T

Project Daniel

Summary

An American built an arm for Daniel. The arm was created using 3D Printers. The local people were trained on how to create more arms.

More information

https://www.youtube.com/watch?v=SDYFMgrjeLg

Emphasising the T

TikTok

Pill Bottle Prototype 1 - Brian Alldridge
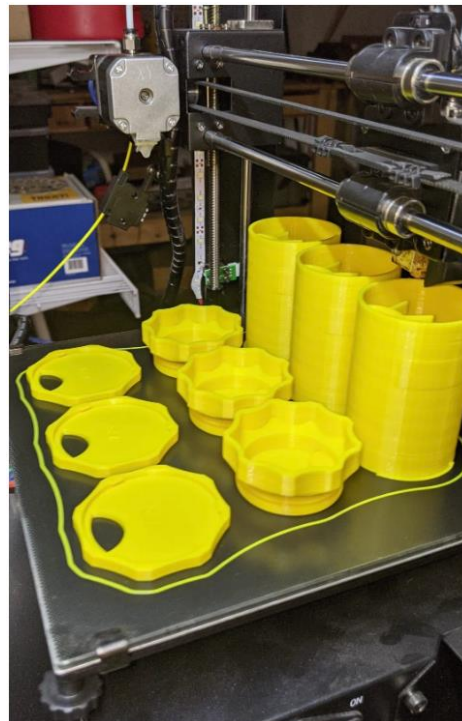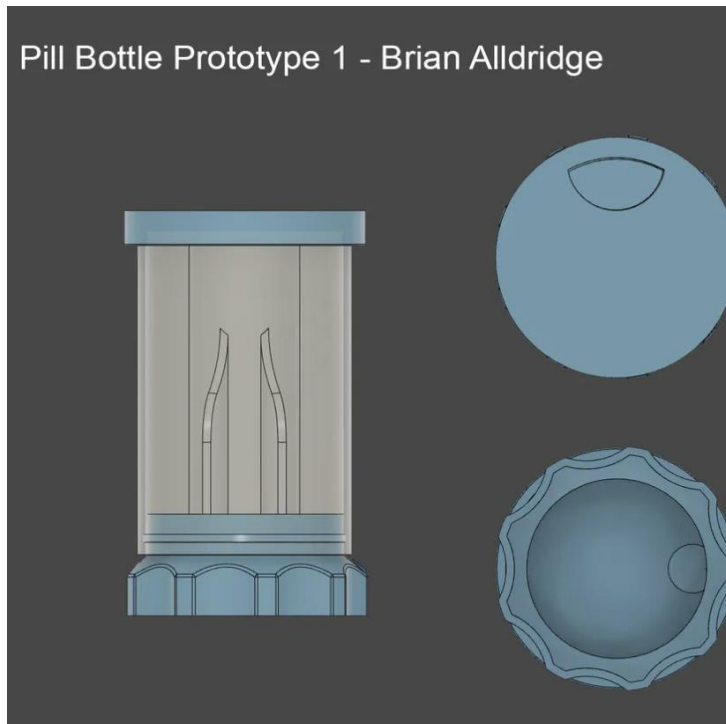
Summary
TikTok was used as a platform to help a man dispense Parkinson's Disease pill easily. Social media brought skilled people together and now the design is open source, helping everyone.

More information
https://www.theverge.com/2021/1/23/2224467 3/parkinsons-tiktok-crowdsourced-pill-bottle

Emphasising the T

Drones Stop Poaching

Summary

Park rangers in Africa stop poaching using programmed drones that locate where the animals are and poachers are likely to strike.

More information

https://mashable.com/archive/drones-stop-rhino-poachers

Emphasising the T

3D Printed Prosthetics for Waddles the duck
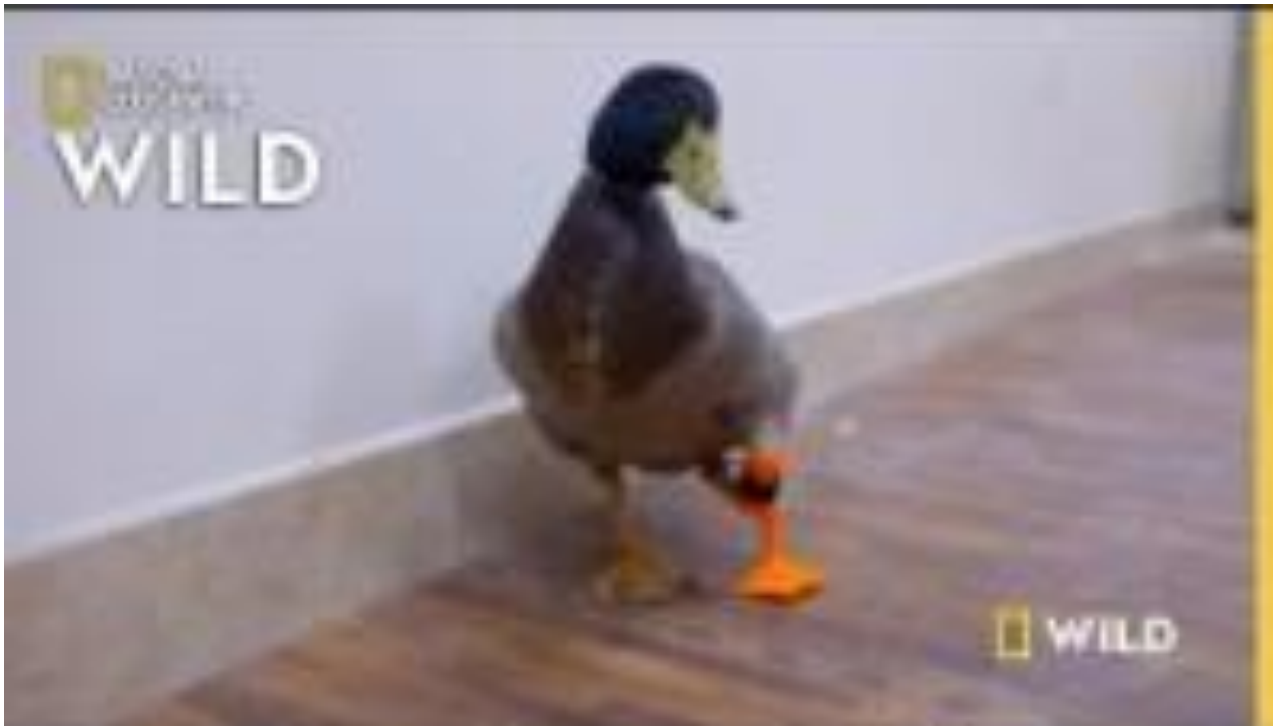
Summary

Waddles the duck was born with a deformed leg. With the help of 3D printers he was given a new leg.

More information

https://mymodernmet.com/duck-prosthetic-leg/

Emphasising the T

3D Printed House for Homeless

Summary

Mobile Loaves & Fishes in Austin, Texas is taking a unique approach to combating homelessness. They're using technology to come up with innovative housing solutions.

More information

https://www.freethink.com/series/catalysts/3d-printed-homes-for-the-homeless

Trends in Schools

No one way to teach STEM. Depend on resourcing (teachers, and teaching resources).

In primary schools seeing an increase in specialist STEM teacher roles.

Embedded into the classroom – role of the classroom teacher.

Secondary school teachers – majority of schools are still siloed subjects. Some schools moving towards a STEM collaboration.

Topic Ideas

Directly relating back to the curriculum. Honor the curriculum.

Create an inquisitive investigation through prompting and questions. What else would you like to know? What is 1 thing you'd like to share?

Take it slow and look for quality opportunities rather than quantity.

Park some of these idea for later! Modify to suit your teaching.

Topic Ideas

- [x] Construction eg: bridges
- [x] UN Sustainable Goals
- [x] Sustainability
- [x] Circuits and electricity
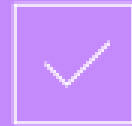
- [x] Solar Power eg: cars
- [x] Rockets
- [x] Smart house designs
- [x] First nations Science

STEM in an Hour
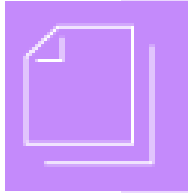
Sustainability

Look at sustainability at the school or local community. Focus on the concept of redesigning. Examples can include; redesign a local playground t be more sustainable or redesign your school garden to grow more eatable fruits and vegetables.

Perfect to Promote:

- Design ideas

- Communication and presentation skills

STEM in an Hour
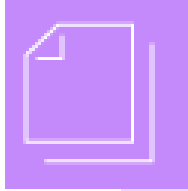
UN Sustainable Goals

Study and look at the UN sustainable goals. Rate the goals from most important to least important. Look at it from the point of view of is technology helping or hampering? How can we use technology to help reach these goals. Look at some technologies and come up with a new design idea.

Perfect to Promote:

- Evaluation and critical thinking

- Research

STEM in an Hour
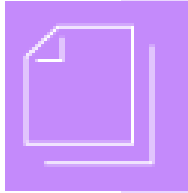
Melting Chocolate

Bring in chocolate buds and look at which type of chocolate melts the quickest. Cath tried and tested: made a foil boat and the boats floated on warm water.

Perfect to Promote:

- Data collection

- Estimation and hypothesis

STEM in an Hour
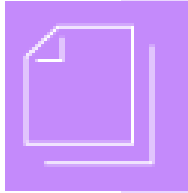
Space Exploration

You need to leave Earth. Which planet would you live on and why. Design a home and explain what features you included and why.

Perfect to Promote:

- Critical thinking skills and evaluation

- Design ideas

- Communication and presentation skills

More information:
https://mars.nasa.gov/mer/
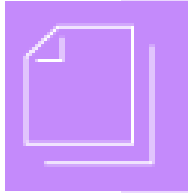
STEM in an Hour

Space Exploration

Send a virtual postcard.

More information
https://mars.nasa.gov/participate/postcard/opportunity-rover/

Perfect to Promote:

- Communication skills

- Questioning

STEM in an Hour
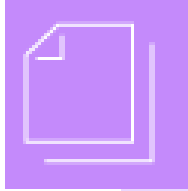
Paper Challenges

Students complete different paper challenges. Pose the activity through a question eg: What's the longest paper chain possible from 1 piece of A3 paper. Which shape is the strongest and can hold the most weight?
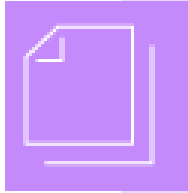
Perfect to Promote:

- Collaboration and teamwork

- Trial and error

- Learning through doing

More ideas:
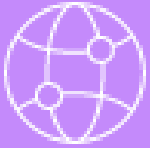https://www.steampoweredfamily.com/no-prep-stem-activities-with-paper/

STEM in an Hour

Bottle Flip

Students flip the bottle of water and make it land correctly. Investigate different amounts of water and styles of flipping that get bottles to flip and stand up.

Perfect to Promote:

- Data Collection

- Graphing

- Promote questioning and exploration. Size of bottles, amount of water

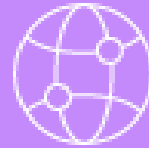More information: https://topdrawer.aamt.edu.au/Statistics/Good-teaching/Data-representation/Creating-pie-graphs

Resources

NESA STEM Education
https://education.nsw.gov.au/teaching-and-learning/curriculum/stem

STEM Education in Victoria
https://www.vic.gov.au/about-stem-education-victoria

Teach Engineering
https://www.teachengineering.org/

ABC Education
https://www.abc.net.au/education/subjects-and-topics

Science Museum Group
https://learning.sciencemuseumgroup.org.uk/learning-resources/
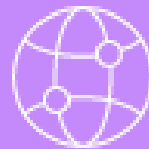
Resources

Primary Connections
https://primaryconnections.org.au/
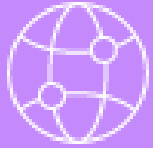
Cool.org (previously known as Cool Australia)
https://cool.org/

STARPortal
https://starportal.edu.au/
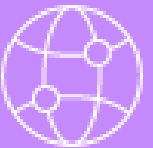
Model Solar Victoria
https://www.modelsolar.org.au/
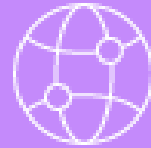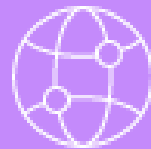
The Girls in STEM Tool Kit
https://www.thegist.edu.au/

Questions and Thankyou

Thank you for your time today, please reach out if you have questions or want to connect further:

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