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Teacher Resource: Rube Goldberg Challenge

What to expect at the workshop

Can you build a complex machine to complete a simple task such as ring a bell? Students will solve a series of challenges using the physics app *Brain it on* and then incorporate their knowledge of simple machines to construct a chain reaction machine named after American engineer and cartoonist, Rube Goldberg. Students will work in groups to solve their designated task with a set of unique materials.

Resources and requirements

- Access to a flexible double classroom
- 30 chairs
- 10 trestle tables
- Supervising teacher

All tools and materials will be supplied. Running time: 90 minutes

Introduction	Introduction to the innovation process and simple machines.
Activity 1: *Brain it On* app challenge	Students will work in pairs to solve as many challenges as they can on the *Brain It On* app in 5 minutes. Students will then be given an additional 3 minutes to solve a custom challenge which will be followed by a discussion about the challenges they faced and the various solutions they came up with. Students are encouraged to be creative and actively incorporate a range of simple machines in their solutions.
Activity 2: Rube Goldberg Challenge	Students will be introduced to Rube Goldberg chain reaction machines through a short video and asked to identify the simple machines used. In pairs/small groups, students will then work together to build their own Rube Goldberg machine using a range of different materials and objects. They will be encouraged to work backwards from their goal i.e. swat a fly, ring a bell, and will aim to have at least 3 steps. They will apply their understanding of simple machines from the previous digital challenges. Throughout this challenge, students are encouraged to test their designs early and often.
Wrap-up	In groups, students will come together to showcase and discuss their machines. They will be asked to reflect on various things such as: • What simple machines they used? • What problems they encountered? How did they tackle them? • If they could do this again, would they do anything differently? If so, what? • Think critically about the materials they were given The session will conclude by linking back to the innovation process and getting the students to reflect on the workshop through feedback forms.

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Rube Goldberg Challenge

Workshop goals

Questacon *Smart Skills* workshops are developed to give secondary school students a challenging hands-on experience with science and technology. The open ended nature of these workshops allows students to explore different ways to solve a problem and helps to build their confidence in trying and testing new ideas.

The *Rube Goldberg* challenge presents students with the challenge of designing and building a chain reaction machine to complete a simple task using simple machines. It takes students through the innovation process of think, make, try and refine. This environment encourages and allows students to learn from their mistakes, which is integral and invaluable to the learning process as a whole.

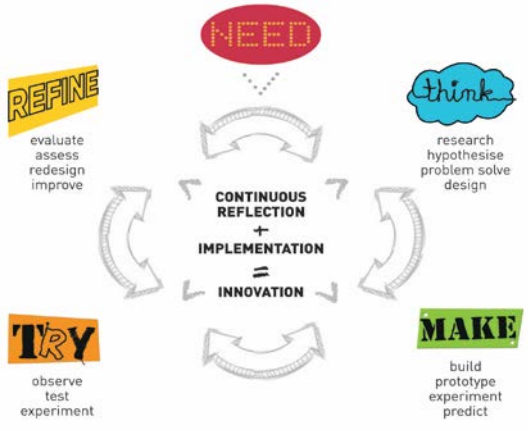
Innovation

Contrary to popular belief, Thomas Edison didn't "invent" the light bulb. He is known for this life changing invention because he improved upon a 50-year-old idea and made it accessible for everyone to use. This process of building on ideas to create something new is called innovation.

We all have the tools we need to be innovative; problem solving, creativity, maths, science and technology, but it's how we use these tools that can make the difference between having an idea and doing something with it.

The process of need, think, make, try, refine is at the heart of any design or engineering feat. These stages don't follow a set pattern or order, but arise naturally from the exploration of new ideas. It can be useful to think about each of these stages as you work on your own designs.

- Does your idea address your **need**?
- Can you **think** of a new or better approach to solve your problem?
- Can you **make** a prototype?
- **Try** out your prototype – does it do what it's supposed to?
- How can you **refine** your design to make it better?



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The Australian National Curriculum: Science

Science Inquiry Skills

The *Rube Goldberg Challenge* addresses all three science strands of the Australian National Curriculum with a strong focus on *Science Inquiry Skills* by encouraging:

- Questioning and predicting
- Planning and conducting
- Processing and analysing data and information
- Evaluating
- Communicating

Science Understanding

This activity links to Physical sciences units in the Science Understanding Strand. This activity can be used to investigate simple machines as well as balanced and unbalanced forces.

Year 7 & Year 8

Change to an object's motion is caused by unbalanced, including Earth's gravitational attraction, forces acting on the object (ACSSU117)

Year 9 & Year 10

The motion of objects can be described and predicted using the laws of physics (ACSSU229)

Science as a Human Endeavour

This workshop is linked to the Science as Human Endeavour Strand through the exploration of the process by which all products undergo to meet a need or want in society. This can be further investigated in the classroom using various related real life inventions such which have gone a through a number of iterations i.e. Dyson products.

Year 7 & 8

Scientific knowledge has changed peoples' understanding of the world and is refined as new evidence becomes available (ACSHE119; ACSHE134)

People use science understanding and skills in their occupations and these have influenced the development of practices in areas of human activity (ACSHE121; ACSHE136)

Year 9 & Year 10

Advances in Scientific understanding often rely on technological advances and are often linked to scientific discoveries (ACSHE158; ACSHE192)

The values and needs of contemporary society can influence the focus of scientific research (ACSHE228; ACSHE230)

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The Australian National Design & Technology Curriculum Links

The *Rube Goldberg Challenge* addresses both strands of the Design and Technologies curriculum. Students will experience the process of planning, designing and refining their prototypes in both a digital and physical context.

Year 7 & Year 8

Design and Technologies Knowledge and Understanding

Investigate the ways in which products, services and environments evolve locally, regionally and globally and how competing factors including social, ethical and sustainability considerations are prioritised in the development of technologies and designed solutions for preferred future (ACTDEK029)

Analyse ways to produce designed solutions through selecting and combining characteristics and properties of materials, systems, components, tools and equipment (ACTDEK034)

Design and Technologies Processes and Production Skills

Critique needs or opportunities for designing and investigate, analyse and select from a range of materials, components, tools, equipment and processes to develop design ideas (ACTDEP035)

Select and justify choices of materials, components, tools, equipment and techniques to effectively and safely make designed solutions (ACTDEP037)

Independently develop criteria for success to assess design ideas, processes and solutions and their sustainability (ACTDEP038)

Use project management processes when working individually and collaboratively to coordinate production of designed solutions (ACTDEP039)

Year 9 & Year 10

Design and Technologies Knowledge and Understanding

Critically analyse factors, including social, ethical and sustainability considerations, that impact on designed solutions for global preferred futures and the complex design and production processes involved (ACTDEK040)

Investigate and make judgments on how the characteristics and properties of materials are combined with force, motion and energy to create engineered solutions (ACTDEK043)

Design and Technologies Processes and Production Skills

Critique needs or opportunities to develop design briefs and investigate and select an increasingly sophisticated range of materials, systems, components, tools and equipment to develop design ideas (ACTDEP048)

Develop, modify and communicate design ideas by applying design thinking, creativity, innovation and enterprise skills of increasing sophistication (ACTDEP049)

Work flexibly to safely test, select, justify and use appropriate technologies and processes to make designed solutions (ACTDEP050)

Evaluate design ideas, processes and solutions against comprehensive criteria for success recognising the need for sustainability (ACTDEP051)