Integrating STEM into the stage 4 curriculum

About me

- UOW graduate B Sci Ed
- Taught at Condobolin High School -4 Years
- Currently teaching at Bowral High School – 5 years
  - Leader of STEM education
  - Integrated STEM school with DoE
  - Current delivering Stage 4 STEM, expanding into stage 3 and 5 in 2017

What is STEM? – School focused

- Apart from the obvious STEM (Science, Technology, Engineering and Maths)
- STEM needs to be an authentic approach to learning that allows students to solve real world problems. It is a methodology to encourage students to use problem solving skills and develop collaborative practices within the classroom, whilst learning key concepts related to the KLAs
- I don't believe an effective stem program is just coding or robotics club (extra curricula)
  - However I do acknowledge the role these do play apart in STEM education

Why STEM

- STEM is vital to our future. STEM innovations drive economic productivity and prosperity.
- STEM innovations and technological advancements also improve our lives and benefit us as a global community. (DET QLD, 2016)
- Allows for project based and inquiry based learning to occur centered around a larger project.
- Increased Student engagement
- Increased student successes
- Increased student retention into senior years
- Increased students engaging in Scientific career paths

STEM activities

- Movie making workshops
- Biofuels
- Inquiry based learning activities
- Meccano
- Submarines
- Extra curricular
  - Lego Robotics
  - Paper plane challenge
  - Science and Engineering challenge

Movie Making

- All stage 4 students complete movie making workshops
- iMovies has been typically used, transition to web based editing software WeVideo this year.
- Students present films in an education week showcase event and also at an end of year community showcase held at local cinema.

- Film is a easy way to capture the students progress in developing solutions.
  - Group rotation to produce film

Bio Fuel

- Video:
- Removed to reduce file size for sharing.
- Video highlighted student work in preparing a biofuel for use in an RC car

Getting out of a sticky situation!

- Modified from Prof LES Kurkup UTS

GETTING OUT OF A STICKY SITUATION!

(Modified from Prof Les Kurkup- UTS)

Scenario:

You work for a company that produces a sticky tape (Tape X).

The Executive Officer of the company approaches you with a tape she has just purchased at OfficeWorks. OfficeWorks claim the tape they sell has better adhesive qualities than any other brand on the market.

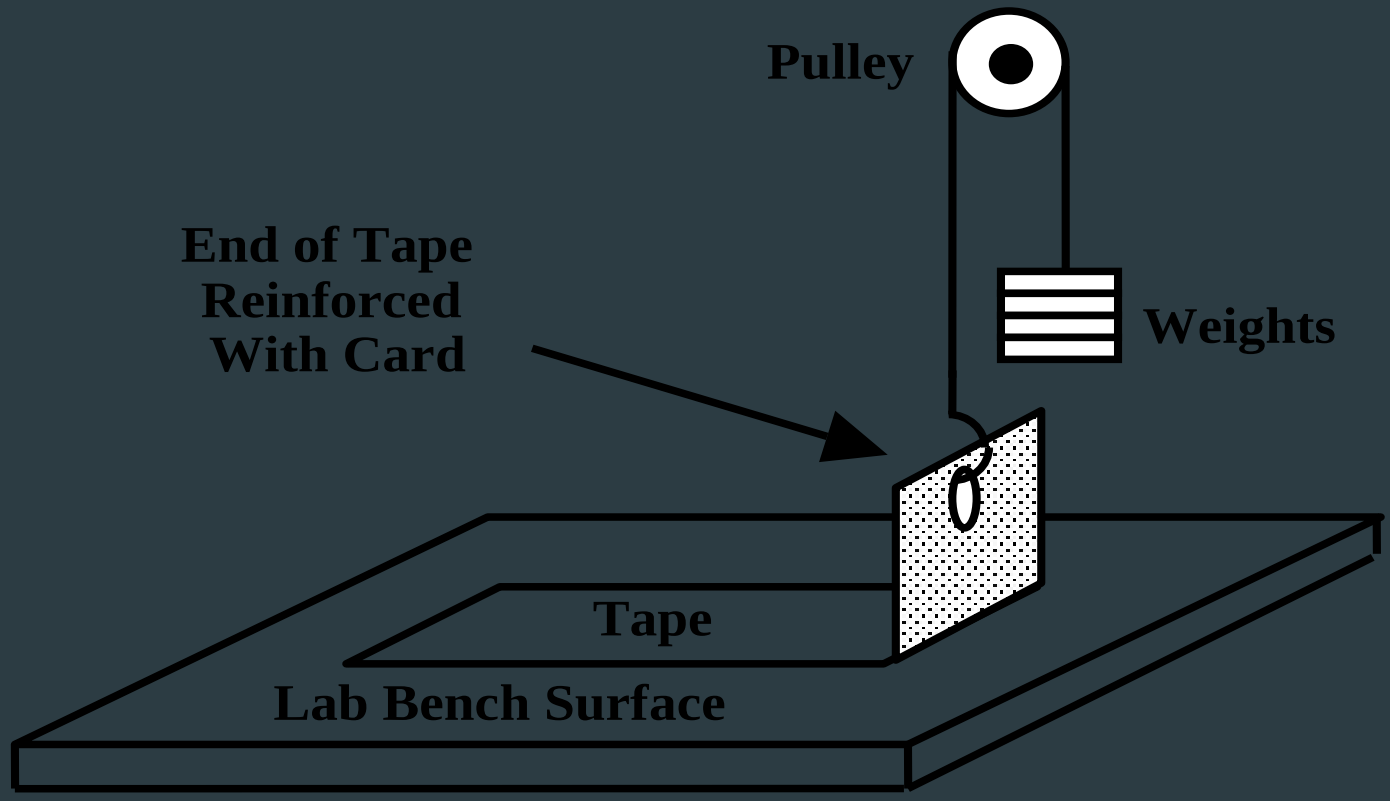
Your Executive Officer wants to know the truth of the matter. Which is better? Tape X or the OfficeWorks tape?

Task:

You are given the task of determining which tape is the better of the two by carrying out a 'stickiness' test on a sample of each tape.

You will report your findings to the Executive Officer. You should be able to describe your methods, your data and any subsequent analysis and conclusion(s).

Getting out of a sticky situation!



We need to Move it, Move it!

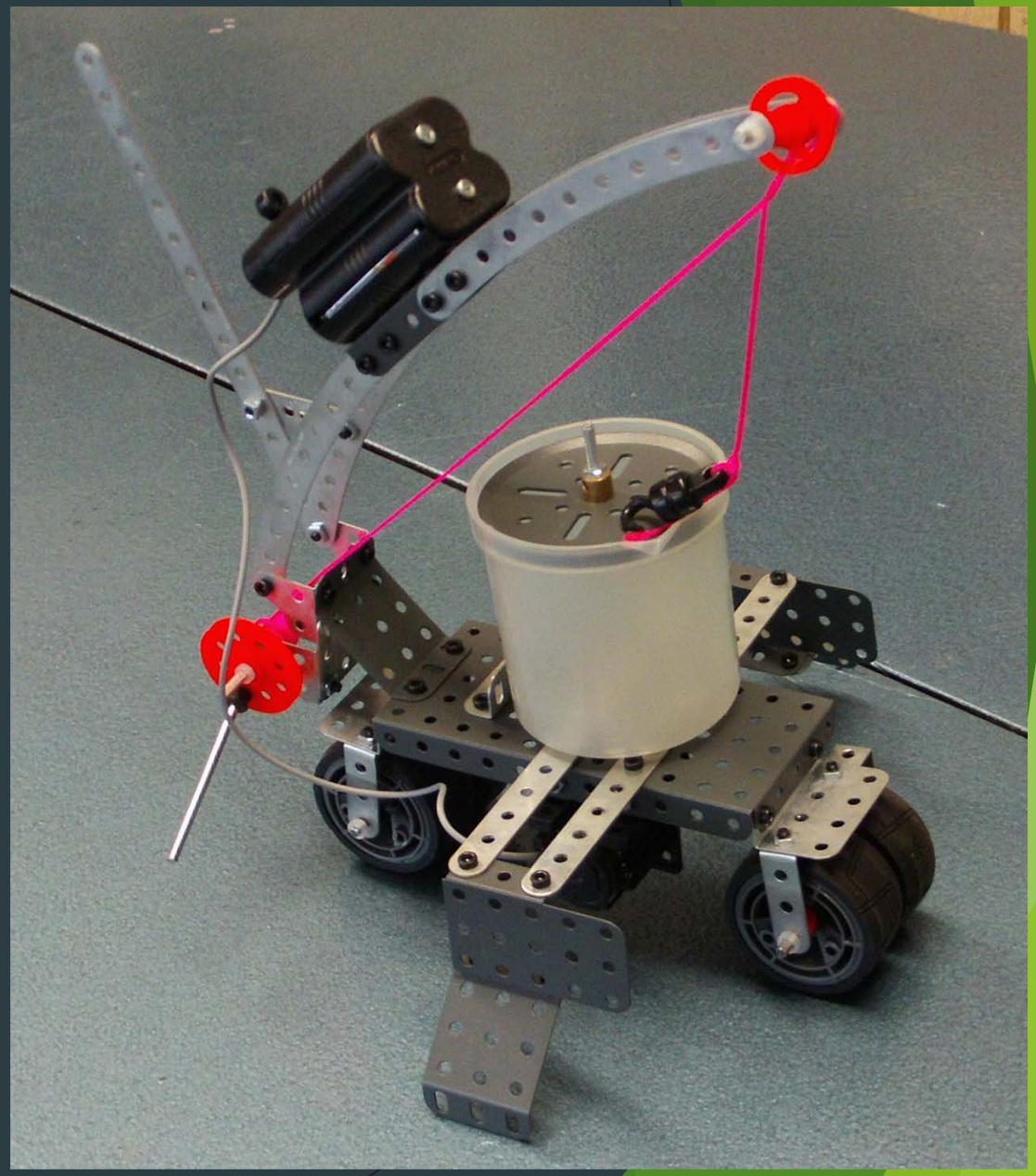
Outcome Mapping

Outcome Mapping **Unit Description:** Students are to design, produce and evaluate a machine that incorporates simple machines to move a sample of "liquid waste" a distance of 5m using no fossil fuel power sources.		
Science	**TAS**	**Mathematics**
SC4-4WS A student identifies questions and problems that can be tested or researched and makes predictions based on scientific knowledge	4.1.1 A student applies design processes that respond to needs and opportunities in each design project.	MA4-1WM A student communicates and connects mathematical ideas using appropriate terminology, diagrams and symbols
SC4-8WS A student selects and uses appropriate strategies, understanding and skills to produce creative and plausible solutions to identified problems	4.2.1 A student generates and communicates creative design ideas and solutions.	MA4-2WM A student applies appropriate mathematical techniques to solve problems
SC4-9WS A student presents science ideas, findings and information to a given audience using appropriate scientific language, text types and representations	4.3.2 A student demonstrates responsible and safe use of a range of tools, materials and techniques in each design project.	MA4-3WM A student recognises and explains mathematical relationships using reasoning
SC4-10PW A student describes the action of unbalanced forces in everyday situations	4.5.1 A student applies management processes to successfully complete design projects.	MA4-4NA A student compares, orders, and calculates with integers, applying a range of strategies to aid computation
SC4-11PW A student discusses how scientific understanding and technological developments have contributed to finding solutions to problems involving energy transfers and transformations	4.5.2 A student produces quality design solutions that respond to identified needs and opportunities in each design project.	MA4-5NA A student operates with fractions, decimals and percentages
	4.6.1 A student applies appropriate evaluation techniques throughout each design project.	MA4-8NA A student generalises number properties to operate with algebraic expressions
		MA4-6NA A student solves financial problems involving purchasing goods

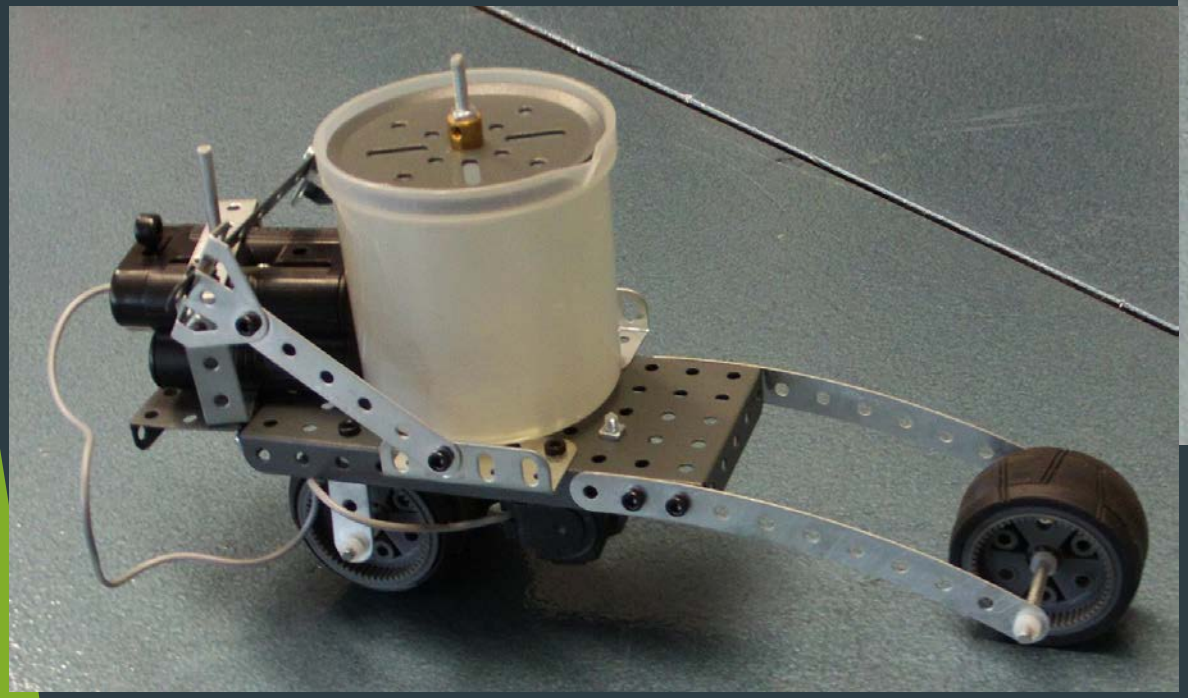
Need to Move it Move it

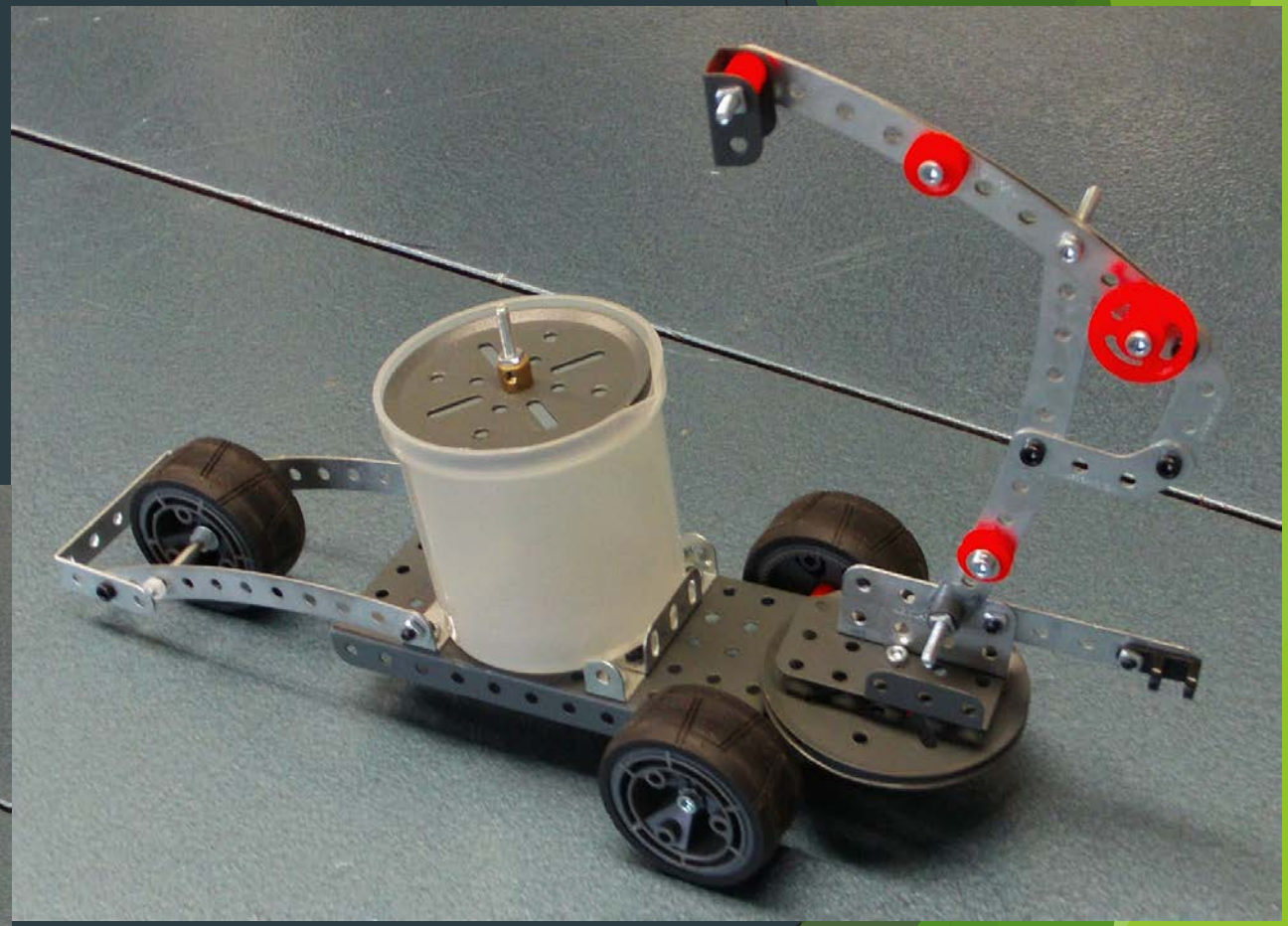
- Video
- Removed to reduce file size for sharing
- Video showed students working on designing, constructing and evaluating vehicle to move liquid waste.

Completed Vehicles

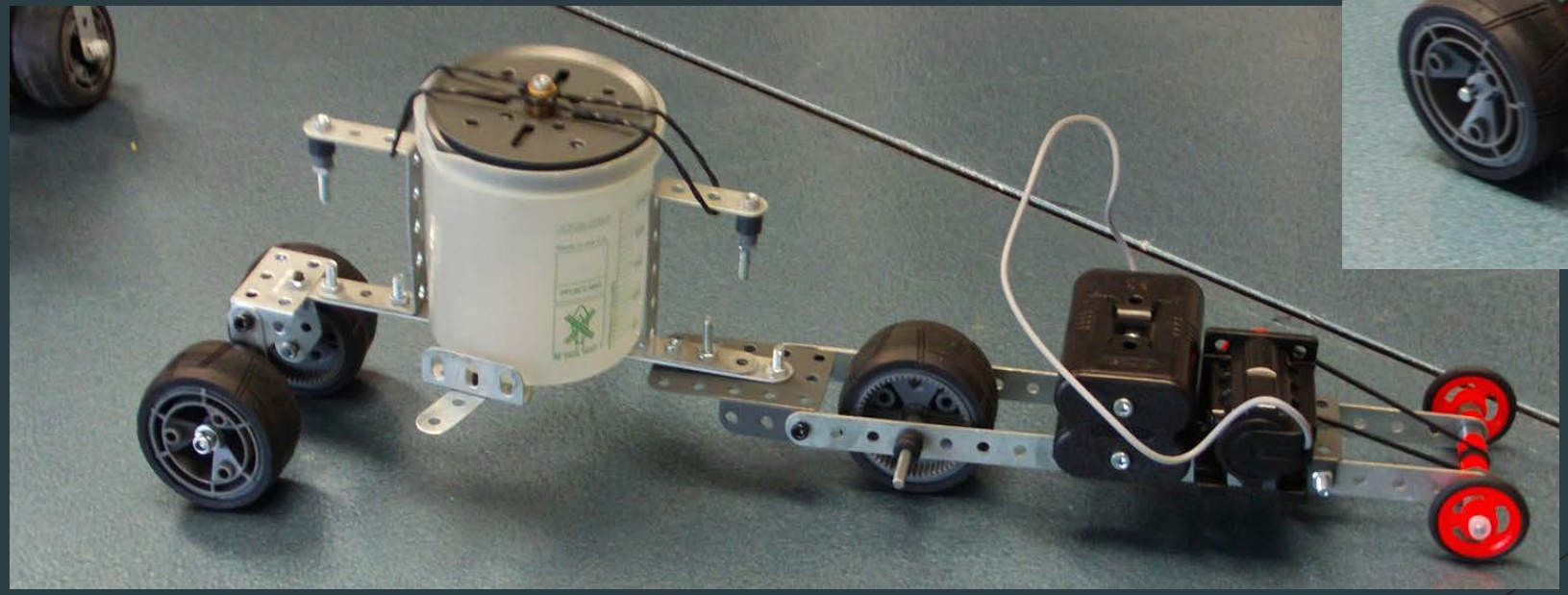


Completed Vehicles

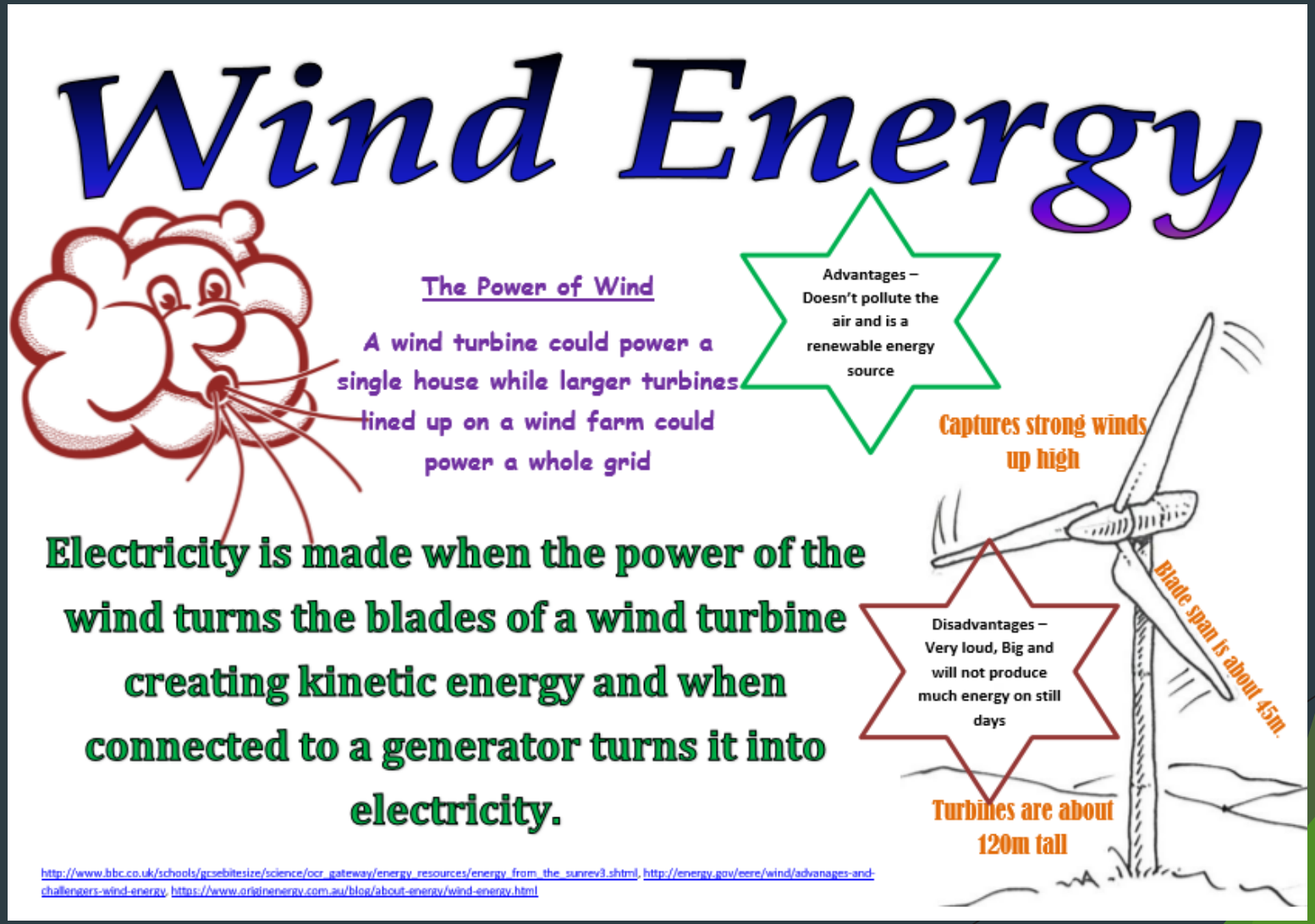




Completed Vehicles



Posters


Wind Energy
The Power of Wind
A wind turbine could power a single house while larger turbines lined up on a wind farm could power a whole grid
Advantages – Doesn't pollute the air and is a renewable energy source
Captures strong winds up high
Blade span is about 45m
Disadvantages – Very loud, Big and will not produce much energy on still days
Turbines are about 120m tall
Electricity is made when the power of the wind turns the blades of a wind turbine creating kinetic energy and when connected to a generator turns it into electricity.
http://www.bbc.co.uk/schools/gcsebitesize/science/ocr_gateway/energy_resources/energy_from_the_sunrev3.shtml, http://energy.gov/eere/wind/advanages-and-challengers-wind-energy, https://www.originenergy.com.au/blog/about-energy/wind-energy.html

Submarine project

STEM SCIENCE TECHNOLOGY ENGINEERING MATHEMATICS
NSW Department of Education

BOWRAL EXCELSIOR

Subaqueous Contraption

Project Description:
A submarine is a vehicle designed to function deep below the ocean's surface. Inside every submarine is a set of hollow chambers called ballast tanks that can be filled with pressurized air or water. As the tanks fill with water, the density of the submarine increases and moves underwater. When the tanks are filled with air, the density of the submarine decreases and the submarine rises. Propellers help drive the submarine forward and hydroplanes steer the vehicle.

TASK:
Design, construct and demonstrate a submarine device that will float, sink and float again **OR** sink, float and sink again in a tank of water 30cm deep. This mission also includes calculating the changing density of your submarine and writing a "captains blog" of your design process. The submarine must as also have at least one 3D printed component.

Restrictions:

- Sub must be larger than 8 cm^3 (2 cm x 2 cm x 2 cm).
- You will have up to 5 minutes to get your submarine to complete its mission
- Presentations will be done in our class tank.
- The density of the water in the tank should remain unchanged after your sub has completed its

Challenges

- Timetable
- Time
- Resources
- Business/university partnerships

Timetabling

As a school we had already two periods per cycle in our stage 4 curriculum for project based learning. These periods were generally staffed by a teacher already teaching that class and used to work on a larger project linking multiple KLA's.

Each class in stage 4 produced a short (5-8 min) movie to show their work throughout the year. These were shown in a showcase event to parents at the local cinema in late November

2015 timetable structure

Period	ThuB
RC	Roll Call
1	HSIE
2	LOTE
R	
3	PROJECT : DACI
4	SCIENCE DACI
L	
5	PE

Timetabling

Problems with current arrangements

- Only a short amount of time each week
- Didn't allow for Science, Maths and TAS teachers to be all involved

Timetabling

Positives with model

- All students are involved in project based learning
- All students undertake film-making workshops
- The presentation of movie in showcase is a very successful model that positively showcases student work and the school to community.
- Films are majority produced by students, with staff assisting as required.

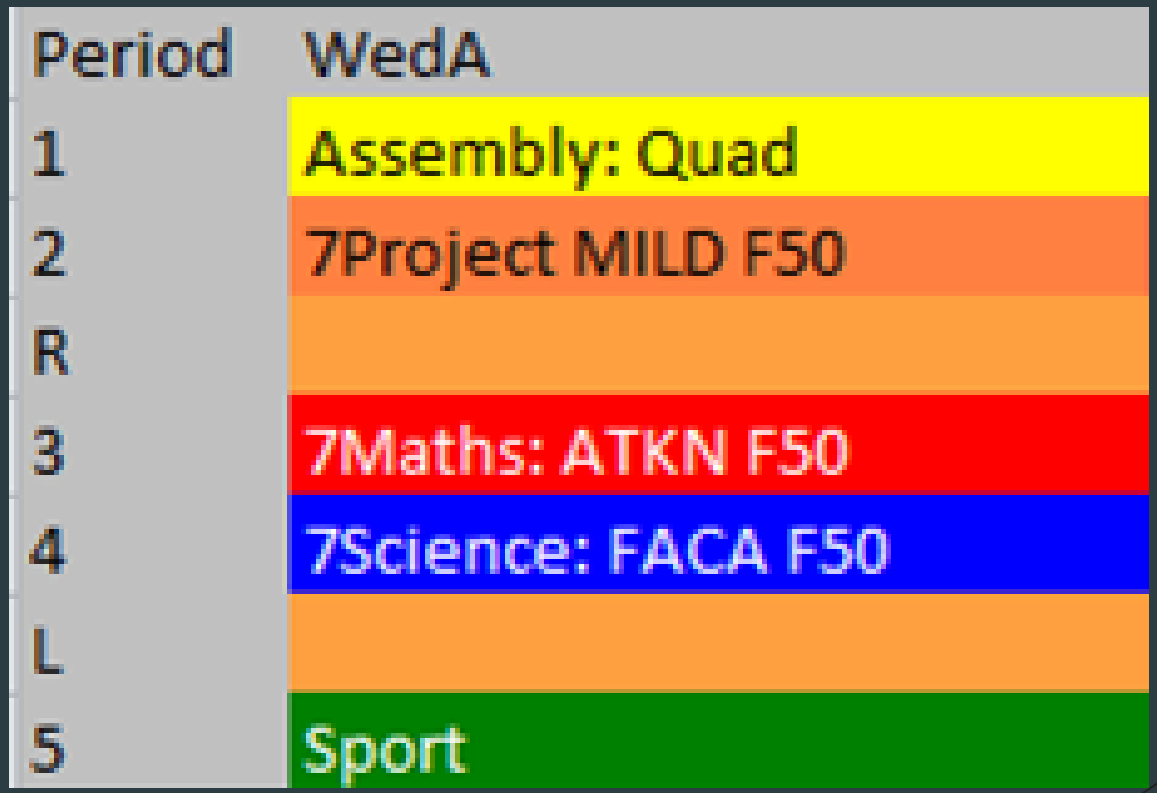
Timetabling - Solutions

More time:- an extra period from Maths and Science per week was used.
Staffing:- Two periods Science, two periods Maths, two periods project(TAS)
Students attended normal Maths and Science lessons each week, however this time was often used to continue working upon their projects.

Timetabling - Student View

Period	WedA
RC	Roll Call
1	Assembly
2	7STEM: MILD F50
R	
3	7STEM: ATKN F50
4	7STEM: FACA F50
L	
5	Sport

Timetabling - Staff View



Period	WedA
1	Assembly: Quad
2	7Project MILD F50
R	
3	7Maths: ATKN F50
4	7Science: FACA F50
L	
5	Sport

Timetabling - Future

Expanding the program into all of stage 4 will allow for modifications to be made to allow vertical TAS in stage 4. This will reduce the amount of Maths time required to be input into the program.

It does impact on total staffing cost though due to reduced class size for TAS subjects but a necessary change for future success.

Need to develop a plan to ensure students don't miss Wednesday due to other school commitments.

Example


Period
WedA
WedB
RC
Roll Call
Roll Call
1
Assembly
Assembly
2
7PROA: MILD F50
7PROA: MILD F50
R
3
7TASA: MILD F50
7MatA: ATKN F50
4
7SCI.A: FACA F50
7SCI.A: FACA F50
L
5
Sport
Sport

Some resources to help

splash ABC

STEM | SCIENCE TECHNOLOGY ENGINEERING MATHEMATICS
NSW Department of Education

UNIVERSITY OF WOLLONGONG AUSTRALIA

Regional Development Australia HUNTER | me program An initiative of RDA Hunter

QUESTIONS

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