Students, thinking, exploring and making

STEM at The Canobolas Rural Technology High School

One year on…

- Matt Scott – Head Teacher STEM

@ The Canobolas Rural Technology High School

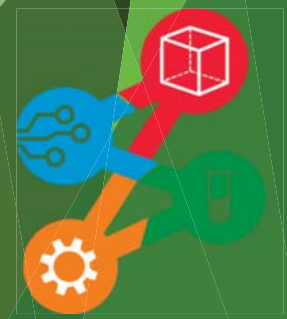
Context:

- Orange, Central West NSW
  - 40,000 population
- 860m above sea level
- Comprehensive 7-12 school
- 595 students
  - includes 60 Support students
- Low Socio-economic area
  - ICSEA value is 872
  - NSW FOEI is 150
- 24% Aboriginal students

Our first steps into STEM

- Incursion activities
  - University of Wollongong STEM road show
  - Robogals three day workshops
  - Engineers without borders
  - Aeronautical Velocity Challenge
  - Mobile makerspace

- Integrated STEM action research
  - 10 Week Stage 5 unit project for ACARA
  - 10 Week Stage 4 unit for DoE



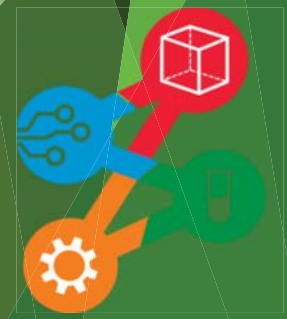
ACARA Trial

- Invited to be one of three schools in NSW to develop and trial an integrated STEM unit in Stage 5.
- Trialled delivery by science, maths and TAS teacher in various rooms.
- While engagement was very evident, continuity and co-ordinating three teachers in three spaces was found to be problematic.

Why STEM?

- We've all seen the statistics…
  - a 58% decline in STEM related course completions between 2001 and 2011 *Australian Industry Group 2013*
  - 44% of of Australian jobs (5.1 million) will be at risk of 'digital disruption' in the next 20 years *Price Waterhouse Coopers 2015*
  - and 75% of the fastest growing jobs require STEM skills *Price Waterhouse Coopers 2015*

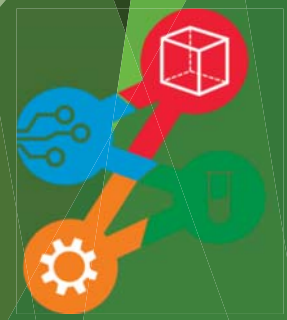
- *For our context, it's more…*
  - *Student engagement through project based learning*
  - *Making links between subject areas for deeper understanding*
  - *Engagement in Science and Mathematics using practical tasks*
  - *'Sir, why do we have to learn this stuff anyway…?'*



Our STEM Curriculum model:

- Built into Stage 4 timetable for all Years 7 and 8.
  - Two 53min lessons each week (four per cycle).
  - Students study STEM for one semester, then rotate to Agriculture for a semester.
  - STEM content is directly aligned to and inspired by the Stage 4 Science scope and sequence.
  - Mathematics is taken from the Stage 4 Mathematics scope and sequence is included where authentic learning opportunities are identified.
  - A consistent feature is the use of the design process from Technology (Mandatory).
  - Four distinct units in Year 7 and four in Year 8.

- Stage 5 iSTEM elective
  - Student driven elective lines at CRTHS
  - Taken up in first year offered, did not detract from Industrial Technology Engineering elective.
  - A very diverse group of students.



Our STEM approach – Filmpond Video

http://bit.ly/1UsHCMD

Our STEM Curriculum outline:

Stage 4 STEM Scope and Sequence - aligned to Science Scope and sequence

Outcomes from science syllabus guide the unit. Each unit incorporates "Working Mathematically" outcomes. All units include Tech Mandatory outcomes.

Year	Term 1	Term 2	Term 3	Term 4
7	**Chemical World** **Science syllabus Outcomes:** SC4-17CW Explains how scientific understanding of, and discoveries about the properties of elements, compounds and mixtures relate to their uses in everyday life	**Earth and Space** **Science syllabus Outcomes:** SC4-12ES describes the dynamic nature of models, theories and laws in developing scientific understanding of the Earth SC4-13ES explains how advances in scientific understanding of processes that occur within and on the Earth, influence the choices people make about resource use and management	**Physical World** **Science syllabus Outcomes:** SC4-10PW describes the action of unbalanced forces in everyday situations SC4-11PW discusses how scientific understanding and technological developments have contributed to finding solutions to problems involving energy transfers and transformations	**Living World** **Science syllabus Outcomes:** SC4-14LW relates the structure and function of living things to their classification, survival and reproduction SC4- 15LW explains how new biological evidence changes people's understanding of the world
STEM project	**Design Brief:** Drought has hit our local community hard, and greatly impacting the survival of farming animals. What water is available is stagnate and its quality is falling. You have been employed by a company to come up with a cheap way to make dirty water clearer. **Featured Project:** Design and make a water cleaner from a used PET Bottle	**Design Brief:** Not all countries are as fortunate as Australia to readily have access to a range a high quality building materials. UNCHR have employed your team to develop a low cost composite material that could be used to cast affordable shelters for people and animals. **Featured Project:** Cast a one-piece shelter from a class determined composite made from a glue and fill.	**Design Brief:** Fossil fuels are becoming less popular globally, due to financial and environmental costs. As fossil fuel resources dwindle, small scale energy generation is becoming popular. Using the STELR kits, create a prototype wind tower turbine to harvest wind energy. **Featured Project:** A tower that supports the STELR wind turbine. Power an electrical device (light globe) using captured wind energy.	**Design Brief:** In the zombie apocalypse, survival is the name of the game. Those who do not adapt may not survive. This includes our robotic assistants. Build a robotics vehicle, then design and code an adaptation for survival. **Featured Project:** Build the base Lego EV3 robot vehicle, add and code an adaptation to help it survive a RoBoWar.

Our STEM Curriculum outline:

Year Group	Term 1	Term 2	Term 3	Term 4
8	**Living World** **Science syllabus Outcomes:** SC4-14LW relates the structure and function of living things to their classification, survival and reproduction SC4-15LW explains how new biological evidence changes people's understanding of the world	**Physical World** **Science syllabus Outcomes:** SC4-8WS selects and uses appropriate strategies, understanding and skills to produce creative and plausible solutions to identified problems SC4-11PW discusses how scientific understanding and technological developments have contributed to finding solutions to problems involving energy transfers and transformations	**Chemical World** **Science syllabus Outcomes:** SC4-16CW describes the observed properties and behaviour of matter, using scientific models and theories about the motion and arrangement of particles SC4-17CW explains how scientific understanding of, and discoveries about the properties of elements, compounds and mixtures relate to their uses in everyday life	**Earth and Space** **Science syllabus Outcomes:** SC4-13ES explains how advances in scientific understanding of processes that occur within and on the Earth, influence the choices people make about resource use and management
STEM project	**Design Brief:** Drought has hit our local community hard, and greatly impacting the survival of food crops. You have been employed by Department of Agriculture and CSIRO to prototype a biodome to sustainably grow food crops in dry climates. **Featured Project:** Design and make a self-watering biodome to sustain a seedling. **Mini-Projects:** Mini self-watering pot	**Design Brief:** Consumer electronics are becoming smaller and more affordable every year, leading to personal devices and the Internet of Things. Taking advantage of such technology, you are to make and code a musical keyboard from waste cardboard that anyone can play. **Featured Project:** A cardboard based keyboard using a Makey Makey development board and coded with Scratch. **Mini-Projects:** Hour of Code	**Design Brief:** Compounds and mixtures have been used to our advantage for hundreds of years, making our lives easier, more comfortable and safer. Explore, discover and apply a mixture that could be used to extinguish a flame. **Featured Project:** Make a fire extinguisher from a PET bottle with a 3D printed nozzle that can deliver CO_2 to extinguish a candle flame. **Mini-Projects:** Kinetic sand Slime	**Design Brief:** In an increasingly throw away world, landfill is becoming a greater issue. Burying non-sustainable resources that do not biodegrade will remain there for decades, if not centuries to come. Alternatives to these materials are in great demand by consumers, when they can be used in practical applications. Create a chocolate mould from your own plastic. **Featured Project:** A mould made from corn starch plastic, shaped using a 3D printed guide. **Mini-Projects:** Glues

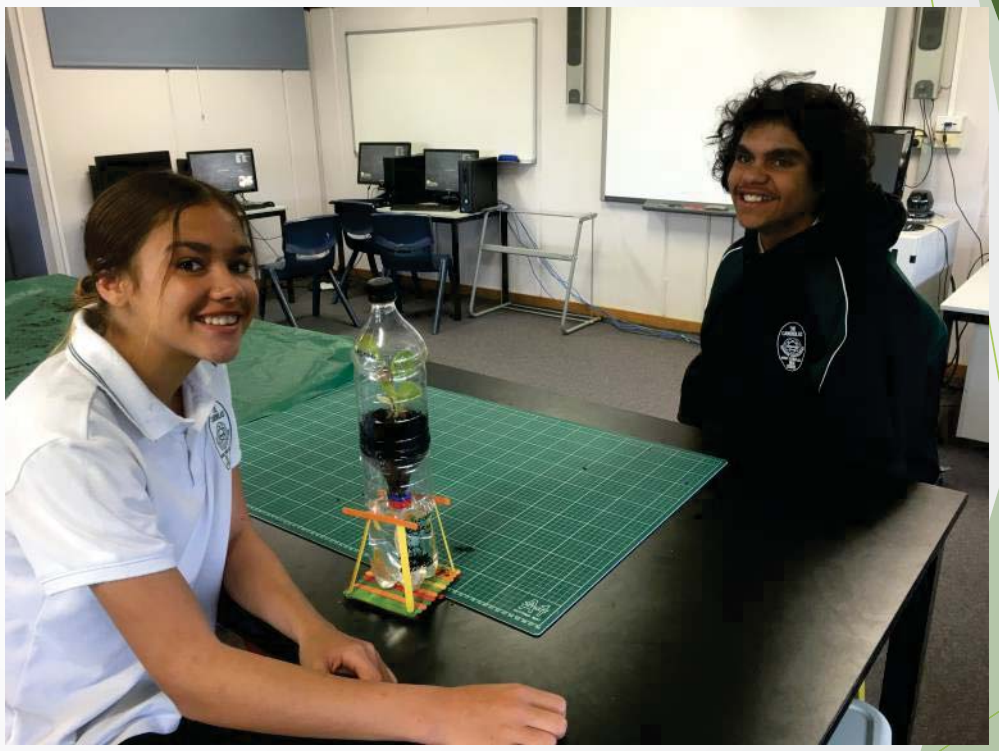
The STEM Centre and STEM Head Teacher

- An Evolution of the existing Library space.
  - Three distinct learning spaces:
    - The thinkerspace: A flexible space for collaborative learning.
    - The explorerspace: A knowledge area featuring traditional books and eLibrary accessed on iPads.
    - The makerspace: A practical space for crafting prototypes and CAD/CAM work.

- Managed by a school-funded Head Teacher STEM
  - Provides whole school professional learning on project based learning, including team teaching.
  - Resourced using school equity funding.

Preliminary findings:

- Term 1 student surveys:
  - 93% of students have a better understanding of STEM.
  - 85% enjoyed working in the STEM Centre.
  - 83% preferred collaborative learning.



Our first Integrated STEM Unit – Filmpond Video

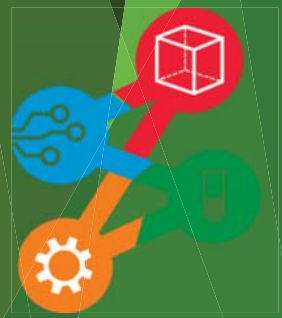
http://bit.ly/1UsHCw4

STEM Transition Project

- Breaking the old reputations…
  - Using STEM and collaborative learning to remind the community about our quality academic programs

- Stage 3->4 Transition
  - HT STEM visiting two Partner Primary Schools every week and other schools visiting Canobolas for STEM immersion workshops.
  - Working with Stage 3 students and teachers on a maker/coding project.
  - Modeling the new Orange Regional Museum and Orange Civic Theatre, designing and making an opening night LED light show powered by Intel Galileo.

- Primary School Roadshows
  - Promoting STEM education through travelling roadshows to Partner Primary Schools.

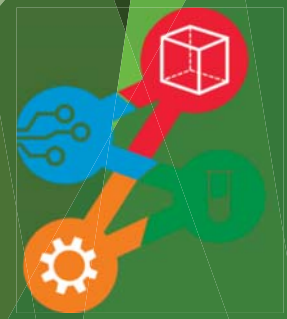


WIN TV Central West – STEM Transition and Coding

https://goo.gl/WwPd2A

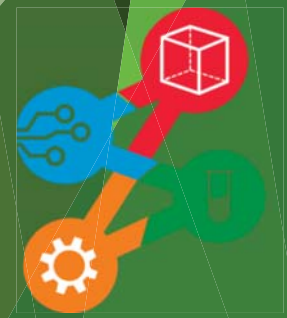
Whole School Profession Learning

- STEM Team – working together with the Head Teacher STEM to identify and plan project based learning activities for the whole school.
- STEM Team members – leading project based learning Professional development with staff in their faculty to build capacity.



NSW Department of Education STEM Action Schools

- The NSW Department of Education has established eight STEM Action Schools in line with the NSW Department of Education STEM Strategic Plan.
- The Canobolas Rural Technology High School is one of eight NSW STEM Action Schools.
  - One of three regional and the only one in Rural NSW.
- The STEM Action Schools will share and support effective STEM pedagogy, illustrate innovative practice for student engagement in STEM, and demonstrate successful leadership, professional learning and industry partnerships.



Our future plans?

- Through applying the Design Thinking process, our vision is to have all students **engaged** in classrooms by staff who feel confident and are competent with embedding **21st Century** learning into every lesson.
- Focus on **transition** both into and leaving high school.
- Building student confidence in writing.
- Incorporate more project-based learning across the school.
- Further cultivate and cement community links.

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THE CANOBOLAS RURAL TECHNOLOGY HIGH SCHOOL

STEM Action School
SCIENCE TECHNOLOGY ENGINEERING MATHEMATICS
NSW Department of Education

NSW GOVERNMENT Education Public Schools