Capacity Building for STEM Teaching: Responses of schools to a professional learning program

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Today

• Hello!

• Today’s Presentation
  • National Education Context
  • State Education Context
  • Local Education Context (Geelong Region & Local Primary Schools)
  • National Science Agenda
  • SEPS Program
  • STEM at Bell Park North
  • STEM at Rollins P.S
“Kids are smart – trust them – don’t talk so much, get out of their way and allow them to show you what they already bring to the table”

- Rob Vingerhoets
Australian Education in Context

- Starting age for students is usually around the age of 5, sometimes 4 years old.

- Typical Primary School day - Literacy, Numeracy and Inquiry.

- Our curriculum is a continuum from Foundation – Level 10

- Science is certainly **NOT** a prominent feature of our daily practice or assessment schedule.

- NAPLAN - Held annually for years 3, 5, 7 and 9. This determines Commonwealth funding.
Australian Education in Context

We have 3 education systems: Government, Independent, Religious.
Australian Education Funding in Context

- Commonwealth government
  - Public schools: 36.2%
  - Private schools: 63.8%

- State/Territory governments
  - Public schools: 91.5%
  - Private schools: 8.5%
Australian Education in Context (State)

Framework for Improving Student Outcomes (FISO).
### Learning Areas

- **The Arts**
  - Dance
  - Drama
  - Media Arts
  - Music
  - Visual Communication Design (7-10)
  - Visual Arts
- **English**
- **Humanities**
  - Civics and Citizenship
  - Economics and Business
  - Geography
  - History
- **Languages**
- **Health and Physical Education**
- **Mathematics**
- **Science**
- **Technologies**
  - Design and Technologies
  - Digital Technologies

### The Victorian Curriculum

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The Victorian Curriculum provides a comprehensive framework for education in Victoria, Australia, detailing the standards and curricula for various subjects and grade levels.
Australian Education in Context (State)

• Department of Education and Training are encouraging schools to adopt STEM culture, to meet future industry demands.

• There is no guiding framework for this.
How do you develop a culture without a set of agreed standards?
Australian Education in Context – Geelong

• 50 Primary schools
• 10 secondary schools
• The Geelong Tech School
• Deakin University – 2 campuses.
• BioLAB
• Gordon TAFE
Australian Education in Context (Local)

• Low socio-economic area.
• Students come from backgrounds that include:
  • Single parent families
  • Trauma and abusive environments
  • Drug affected homes
  • English as a second language
  • Refugee families
  • Learning disabilities and difficulties
• Many teachers enrol their children in private schools.
Where we come from... Bell Park North Primary School
STEM within the National Innovation and Science Agenda (Theory)

- There are 5 main areas of focus for STEM in Australia:
  - Increasing student STEM ability, engagement, participation and aspiration.
  - Increasing teacher capacity and STEM teaching quality
  - Supporting STEM education opportunities within school systems.
  - Facilitating effective partnerships with tertiary education providers, business and industry.
  - Building a strong evidence base.

- Problem: Many of the initiatives aimed at students begin at secondary level.
STEM within the National Innovation and Science Agenda (In Practice)

• 20-year decline in year 12 science and maths participation

• Research has found engaging children in science before the age of 11 was critical to their long-term interest in the subject.

• One of the recommendations...was for all primary schools to have a specialist science/STEM teacher.

• If the teacher is engaging, wanting to work WITH the student, then the student wanted to study it the next year.
STEM within the National Innovation and Science Agenda (Geelong)

- We are currently following global trends but have an eye on becoming an innovator.
- Geelong « ‘hard’ industry such as aluminium smelters (ALCOA) and the car industry (FORD) have closed.
- There were concerns for unemployment rates « but new tech jobs now employ more people than the previously mentioned industries
- Deakin University’s Carbon Revolution.
- Repurposing: Wind turbines are now also produced in the old Ford factory.
STEM within the National Innovation and Science Agenda - Industry

From this...  To this...

Ford  ALCOA  Shell  Target

RIP CURL  DEAKIN UNIVERSITY
SEPS - STEM and Entrepreneurship in Primary Schools

• SEPS - STEM and Entrepreneurship in Primary Schools is a recent collective of Geelong schools under the direction of Deakin University.

• It is a learning program aimed at upskilling primary schools and allowing 13 schools to support one another whilst fostering a love of STEM.

• Some schools have been ‘doing’ STEM for 6-7 years whilst others have only just begun their journey.
SEPS - Teacher Capacity Building

• Collaboration.

• Curriculum Development and Implementation

• Student Learning and Engagement

• GALS (Girls as Leaders in STEM)

• Great to see different systems – pick up points that work for our school context.

• There has been a lack of STEM leadership/development with schools but Deakin has provided this opportunity to participate in this learning program.
STEM @ BPNPS (Overarching Framework)

• STEM did not exist in 2017. Through SEPS, we have collaborated to establish the following commitments to STEM:

  • Two STEM Coordinators ⇒ ability to collaborate and collect information.
  • STEM timetabled for 1 session per week.
  • Purchased several technologies to complement learning.
    • Tech is rotated through school on a term by term basis
    • This enables students and staff to build expertise.
  • Increased collaboration and improved planning (amongst staff).
  • Focus on Design in Terms 1 and 2 ⇒ Implementation in Terms 3 and 4.
STEM @ BPNPS (STEM & Technology)

- Purchased several technologies to complement learning.
- Rotated throughout the school on a termly basis.
STEM @ BPNPS (Pedagogy)

• Inquiry driven curriculum – use of Science & Humanities curriculum to lead/guide maths and literacy.

• This:
  • allows us to teach ‘through’ an activity instead of ‘to’ an activity.
  • ensures patience through the curriculum.
    • allows time to figure out what the students NEED and what will benefit the whole school.
  • allows students to make connections and explore topics in depth.
THINK LIKE A DESIGNER

3/4 INQUIRY

ETHICAL CAPABILITY

PERSONAL & SOCIAL CAPABILITIES

RESEARCH

SPATIAL SKILLS

WRITING (CURRICULUM)

WRITING (6H)

SPEAKING

SPELLLING

MATHS

N/A

M/L

S/P

NUMERACY

CAPABILITIES

INQUIRY/STEM

PERSONAL & SOCIAL CAPABILITIES

READINhG

EXCELLENT
STEM @ BPNPS (In Practice)

• Interconnectedness between the curriculum - true Inquiry!

• Golf Course, Pinball Machine and Sphero Maze projects.

• Learning processes (with outcome in mind) are the clear centre point to these projects.

• Technology then used to engage, foster exploration and innovate within tasks.
For example:
Design project – construct project -tech then complements learning
For example:

There is a clear objective but several ways to get there. ‘Touch’ points are vital throughout but curriculum knowledge is a key for discussion.

Touch points throughout this project were seen through maths, reading and writing, as well as team work, collaboration and problem solving.
STEM @ BPNPS

• Key Ideology:
  • Decision making and problem solving (key skills for life and education)
  • Teamwork and collaboration (also central themes to life) – open the door for students!!

• Design Briefs:
  • essential tool for project learning.
  • Allow students (and teachers) to focus on the process.
  • Allow us to teach ‘through’ tasks, not ‘to’ tasks!!

“Why would you tell a student something that they could work out for themselves – if you set up the opportunity” – Rob Vingerhoets
STEM @ BPNPS (Evolution of a Task)

2016/2017
Mini-Golf: ‘Design’ Project

2018
Mini-Golf: Design, Construct & Play

2019
‘Sphero’ Maze: Code & Collect
These types of projects certainly help with this...

According to the World Economic Forum, the top ten skills required by employers in the year 2020 will include:

1. Complex problem solving
2. Critical thinking
3. Creativity
4. People management
5. Coordinating with others
6. Emotional intelligence
7. Judgment and decision making
8. Service orientation
9. Negotiation, and
10. Cognitive flexibility

Source: Future of Jobs Report, World Economic Forum
Where we come from... Rollins Primary
Rollins Primary School interpretation of STEM

- STEM has been running for 18 months: Arts added this year
- Topics based on inquiry and is driven by a problematic question
- STEAM runs as a specialist class
- Long term goal: embed STEAM in classroom with cross curricular links
- Driven mainly by Principal and STEAM teacher
- Funding in 2018: enabled us to buy resources to re-design a classroom dedicated to STEM
- Teacher acts as a facilitator to encourage creativity and entrepreneurial skills & never show a final product or directly answer a question
- Value relationships and collaboration within the SEPS community
At Rollins, our aim is to apply STEM as ‘a way of thinking, not just a subject’
Science

Science as a human endeavour
Scientific understandings, discoveries and inventions are used to inform personal and community decisions and to solve problems that directly affect people’s lives (VCSSU073)

Analysing and evaluating
Suggest improvements to the methods used to investigate a question or solve a problem (VCSI087)

Chemical sciences
Solids, liquids and gases behave in different ways and have observable properties that help to classify them (VCSSU076)

Maths

Using units of measurement
Connect volume and capacity and their units of measurement (VCMMG225)
Connect decimal representations to the metric system (VCMMG222)

Money and financial mathematics
Investigate and calculate percentage discounts of 10%, 25% and 50% on sale items, with and without digital technologies (VCMNA218)

Fractions and decimals
Add and subtract decimals, with and without digital technologies, and use estimation and rounding to check the reasonableness of answers (VCMNA214)

Arts

Present and Perform
Create and display artwork considering how ideas can be expressed to an audience (VCAVAP031)

Rehearse and perform songs and music they have learnt, including their own compositions, combining aspects of the elements of music and using performance skills, to communicate ideas and intentions to an audience (VCAMUP031)

Technology

Technologies and Society
Investigate how people in design and technologies occupations address competing considerations, including sustainability, in the design of solutions for current and future use (VCDSTS033)

Engineering

Producing
Apply safe procedures when using a variety of materials, components, tools, equipment and techniques to produce designed solutions (VCDSCD040)
Full STEAM Ahead at Rollins PS

At Rollins PS, STEAM is:

• inquiry driven and links in with the Victorian Curriculum
• used as a supportive tool for enhancing classroom learning for Inquiry and literacy for each year level (P-6)
• promoted as a ‘way of thinking’ with real world connections and links to careers
• the vehicle for hands on activity that inspires students to be creative and enjoy their learning in the sciences and maths
• including industry and specialists to share in the educational experience

Our aim is to inspire students to aspire for careers in STEM
Where to from here?

• Department Level Meetings (Sharing)
• Principal Class Meetings (Developing)
• Strengthening Geelong STEM Network (Embedding)
• Further Improving Teaching Practices (Engaging)
• Push for increased STEM participation in early years (Revolutionising)
• Primary Focussed Tech Schools (Dreaming!)

*Deakin University have received further funding for a SEPS 2.0 Group (Building)*
Thank you and if you would like any further information please feel free to contact us...

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