

StepUp



The STEM Studio

What is the STEM Studio?

The **STEM Studio** is a collaborative space for pre-service teachers to work with an in-service teacher, discipline expert and teacher educator to design and deliver transdisciplinary STEM education in an authentic, supportive and non-assessed environment.

STEM Studio is a collaborative project between QUT, James Cook University and Griffith University and has been running since 2015.



The STEM Studio is a Step Up initiative and supported by the Australian Government Office for Learning & Teaching.

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Principles of STEM Studio

- The **Nature of Science** is interwoven within all learning experiences so that participants (including PST's and Students) gain a deeper understanding of these.
- The STEM Studio provides a **collaborative 'third space'** which includes support for pre-service teacher from practicing teacher, discipline expert and teacher educator.
- The STEM Studio uses innovative strategies and creative thinking to **trial new approaches to teaching STEM** using science inquiry and design processes.



STEM Studio Approaches

In classrooms Years 7 to 10

4 sessions within an existing 10 week unit of work within a STEM elective or Science unit

Focuses on engaging student learning experiences rather than knowledge structures using design challenges

Students have access to scientists and facilities at QUT

Partnerships between 6 schools across all school sectors including 33 Pre-service teachers, 11 In-service teachers, 12 Scientists, and over 200 high school students have been involved.

After School Science Clubs Years 6 to 8

Two clubs, 24 students per club
Pre-service teachers (7) volunteer to facilitate the weekly club meetings

STEM experts collaborate on the development of the activities for each week

Partnership between Inspiring Australia, the Museum of Tropical Queensland, James Cook University in collaboration with City Libraries – Townsville.

Extra-curricular projects Years 7 to 10

Linked with the annual Gold Coast STEM Convention hosted at Griffith University.

Based on student driven inquiry - students chose their own inquiry based project

Students work closely with pre-service teachers over 6 weeks to develop their project.

Students present project at community showcase event STEM Convention hosted at Griffith University.

Feedback — In-service Teachers

*“An excellent way to **inspire students** through engaging in **innovative learning** activities.*

*“Students are dealing with **real problems in a rich environment**. It engages students to identify gaps in their knowledge and ways to address these gaps, problem-solve and data analysis approaches- all this occurring whilst they work in a **collaborative team**.”*



Feedback — Pre-service Teachers

*“It has given me **confidence to use constructivist techniques** rather than just chalk and talk. Gaining experience in front of a class, receiving **comprehensive and timely feedback** and **being encouraged** and advised on lesson activities has **accelerated my development as a teacher**”*

*“I have **shifted my focus** from 'I need to teach this' to 'Do the students understand what I'm teaching?'. I **feel more comfortable extending activities** and discussion if it benefits the students and **less worried about getting through all the content** in one lesson.”*



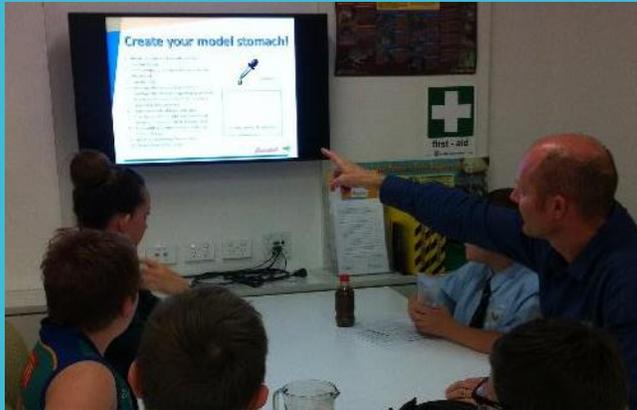
Feedback — Teacher Educators

*“Through participating in the STEM studio, the pre-service teachers are being exposed to **contemporary STEM concepts and ideas**, and they are **learning how to develop relevant, engaging, hands-on activities for students**. They also have the chance to implement classroom management strategies and to **evaluate their success as curriculum managers in relation to the student-centred, open and guided inquiry experiences** facilitated by the studio.”*

*The STEM Studio provides **ongoing one-on-one consultation** where **PSTs are given the opportunity to switch their focus from ‘the teacher teaching’ to ‘students learning’**, and where they can consider lesson experiences **through the student lens** and practice the process of designing engaging units and lessons that balance student engagement and classroom practicalities.*

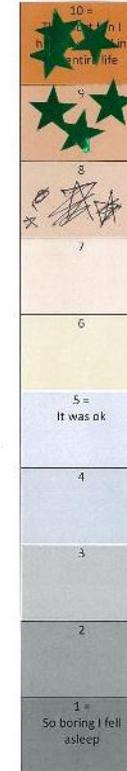


Feedback — Students



Feedback: Fun-o-meter

Place a star sticker on this scale to let us know how much fun you have had at Science Club today:



Use this blank space to tell us what you learned today:

how to code on python and some weird robot thing

Games

I learnt how to code a high Robo.
How to code a robot

Henry

DMG. This was awesome!!
I learnt how to code robots!!!

how to program robots
CALMDC

codefun
10/10
Wow fun
Wow .
much code

10/10

STEM in the classroom

Tell us your ideas!

What STEM topics have you tried in the classroom?

What STEM topics are you interested in teaching?

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STEM Studio Topics

- Brush bots
- Skinny science
- Ozobots
- Acids & bases
- Forensic Science
- Mineralogy
- Cephalopod comparative anatomy
- Scratch coding
- NAO coding
- Psychology & optical illusions
- Lego Mindstorm – mechanical advantage challenge
- Science site tours
- Air Cannon Challenge as part of JCU Open Day & National Science Week
- Sound
- Biofuels
- Concrete
- Catapults (Lego robotics)
- Body Systems & Homeostasis
- Eco-housing and sustainability (Arduino)
- Science of Flight
- Bridges
- Water
- Optics
- Astrophysics

The Brief

Your team has been invited to submit a tender design for an iconic new tower to be built in Brisbane.

The design brief is to construct the tallest, free standing model to sell your concept.

Resources per group:

- 30 Business Cards
- 1 box Paper Clips

Time to plan and construct 7.5 mins



Part 2

How did you go?

Lets try that again!



Activity 2

How does this relate to the
STEM Studio approach?

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Case Study

The Gap State High School

- **Biofuels**
- 8 Pre-service teachers over 8 weeks
- Teacher Educator feedback and contribution
- In-service Teacher direction and feedback
- Trialling new strategies
- Growing in confidence



Case Study

Involvement

- Meeting with the STEM Studio team prior to the 4 sessions
- Observation lesson for pre-service teachers
- Filming of lessons- paperwork
- Feedback to pre-service teachers in planning phase and post-teaching
- Planning excursion to QUT- paperwork



Case Study

Advantages

- Real problem
- Results are rich
- Co-ordination between tertiary and secondary was excellent
- Access to experts and equipment
- Inspiration for students
- Year 9 stage heavily scaffolded to provide guidance through the Engineering Design process
- Provided clarification for me- establishing the question/problem is absolutely crucial

Disadvantages

- Time involvement (well worth it)
- Time to develop program; give yourself permission to fail - eg. Biogas
- Flexibility is a must- try new things, change direction

Unpacking STEM

Operationalising STEM

Thinking about **STEM** as a *verb* rather than a *noun*

- Teaching STEM: Science Concepts vs Engineering Process
- **Scaffolding** for failure in the classroom using a design process
- Allows **Reflection** on conceptual understanding
- **Redesign** curriculum for open STEM inquiry
- **Designing** STEM challenges



Unpacking STEM

Using these principles and hearing from a practicing STEM teacher how might you **unpack STEM in your context?**



How transferable are the principles of the STEM Studio?

Further information

What's next?

STEM Studio team is planning to develop an online course around using the Design Process in STEM Education

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