# Making Maths Meaningful

Olivia Jessop

# Today's objectives

**Engage with**

1. **Pedagogical strategies that connect abstract mathematical concepts to relatable, real-world contexts**
2. **Approaches to boost student confidence, understanding, and engagement**
3. **Reflection on current practice**

# About me

- **FHEA**
- **Scientist (Boeing)**
- **Teach early foundational maths, med research**
- **Course redesign for online transition during Covid**
- **ATSE educational forum**
- **Passionate about engagement, rural science**

# About you: padlet

**What's everyone's background?**

**Do you actively teach?**

**Subject matter expertise?**

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# Challenges with student engagement: padlet

**Are any within your domain of control?**

**Can any of these be designed for?**

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# Personal teaching philosophy

**Mine:**

- Sense of belonging,
- Experiential learning,
- Peer:peer engagement for student directed learning,
- Strong belief that attention is designed for, not demanded.

**NUDGING**

**EXPECTATION MANAGEMENT**

**CLASSROOM MANAGEMENT**

# Emoji signposting

1

🏡 Back in the main room, one person from each group should write your group's model(s) on the whiteboard.

# Emoji signposting

1

2



🏠 Back in the main room, one person from each group should write your group's model(s) on the whiteboard.

💡 In breakout rooms, have the tallest person share a whiteboard.

# Emoji signposting

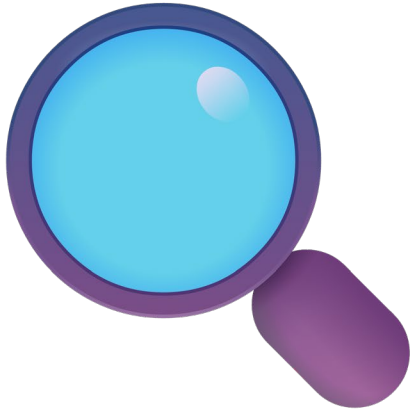
1



2



3



🏠 Back in the main room, one person from each group should write your group's model(s) on the whiteboard.

💡 In breakout rooms, have the tallest person share a whiteboard.

🔍 By yourself, in focus mode:

# Constructivism

A learning theory and philosophical paradigm proposing **that individuals actively construct their own understanding and knowledge of the world** through experiences, reflection, and social interaction.

Instead of passively absorbing information, learners build meaning by interpreting new experiences through the lens of their existing knowledge.

Real world connection: designing tasks that allow students to apply maths to own lives and authentic contexts

# Constructivism: designing for success

- Students take pieces and put them together in their own unique way, building something different than what another student will build.
- Learning is a social activity.
- Hands-on experiences and physical actions are necessary for learning, but those elements aren’t enough.
- Engaging the mind is key to successful learning.

# Experiential learning

- So students can effectively engage, maximise experiential learning for them
- Experiencing – Reflecting – Thinking – Acting.
- The experiential educator moves among four roles: Facilitator, Expert, Evaluator, and Coach
- Social constructivism (Lev Vygotsky)

# Experiential learning: designing for success

**Discussion, problem solving, peer explanation**

**Jigsaw** : Jigsaw learning is a cooperative teaching technique where students are divided into small "home groups" and then "expert groups" to research specific subtopics

**Think pair share**

**Maintaining appropriate challenge**

- 80% success leads to learning new
- Reduces maths anxiety

# Jigsaw questions

- **Think**---we have designed a survey about your attitudes to science, mathematics and computer science. Your participation in the survey is not compulsory. Before you choose whether or not to complete the survey, you must read a survey information form and a survey consent form. Click here to begin (or type https://survey.app.uq.edu.au/SEM1_2023_W1 into a web browser). If you do not yet have internet access at UQ, you are welcome to use a phone or any other device that you may have handy for getting on the web.

- **Pair**---having primed your thinking with the survey, you will now form groups of 2 or 3 for a discussion on attitudes to science, mathematics and computer science. Briefly discuss each of the following:

    1. Compare and contrast your *experiences* so far of science, mathematics and computer programming.

    2. Compare and contrast your *attitudes* to science, mathematics and computer programming.

    3. Is mathematics a science? Justify your answer.

    4. Can one be a good scientist without engaging in mathematics or computer programming?

    5. What advantages are there for a scientist who is comfortable engaging in mathematics and computer programming?

- **Share**---your tutors will lead a brief class-wide discussion to bring out the main themes of the pairwise discussions.

# Jigsaw questions

Slide Type Slide

💡 Brainstorming time in breakout rooms.

- **Pair**---having primed your thinking with the survey, you will now be put into breakout rooms of groups of 2 or 3 for a discussion on attitudes to science, mathematics and computer science. There will be 6 groups. Each will be assigned an argument. **Briefly discuss your argument, and come up with key points.** One person from each group will be asked to share their answers with the class)

1. Is mathematics a science? YES
2. Is mathematics a science? NO
3. Can one be a good scientist without engaging in mathematics? YES
4. Can one be a good scientist without engaging in mathematics? NO
5. Can one be a good scientist without engaging in computer programming? YES
6. Can one be a good scientist without engaging in computer programming? NO

Slide Type Slide

🏠In the main room:

- **Share**---your tutors will lead a brief class-wide discussion to bring out the main themes of the pairwise discussions.Then, they will breifly poll you on your *experiences* and *attitudes* so far of science, mathematics and computer programming.

# Behavioural engagement

Consistent attendance, completing assignments, coming to class prepared, participating in class

Explicit instruction takes away onus on student

Direct vs student led balance: intrinsic vs external motivation

Changing behaviour leads to changing attitudes, very difficult to influence the other way round

Refresher on optional things that we take for granted: classroom layout/seating plans, visuals

# Behavioural engagement: designing for success

**Something relevant to real world**

**I.e. sine wave what is each bit, what can be modelled with a sine wave, chunk success up.**

**All objectives out for advanced students**

**Reinforcing, done this part, little wins and cognitive constructivism (Jean Piaget)**

**Gamification:**

- **instant feedback**
- **levels/progression**
- **rewards/milestones**

# Gamification: padlet

**What could gamification look like for you?**

**Small achievements**

**Rewards**

**Using a specific platform?**

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# Connecting with emotions

**Emotion drives memory**

**Math does not have to be sterile**

# Connecting with emotions: designing for success

**Connect with emotions. I.e. orbits and how newton used to annoy someone.**


**Apply to students lives authentic concepts**

Analyse systems, challenge assumptions, understand society

Maths used to understand, analyse and challenge social political economic structures:

- Health policy and YPLL, or contribution to economy
- Your generation in charge of challenging these concepts

$$\text{weight}_i = n_i \left( \sum_{j=i}^{i+L_i} I(j) \right)$$

**Storytelling**

**Curiosity**

**Humour/conflict**

# Summary: padlet

**Constructivism**

**Behavioural engagement**

**Experiential learning**

**Gamification**

**Emotional connection**

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# Reflection: padlet

**How can one of these be applied to your context?**

**Small changes big impact**

**A strategy you'll try**

**A barrier you'll need to manage**

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# Closing words

**Design practice influences engagement**

**We can focus on extrinsic motivators and effective structure**

**Do what works for YOU**

# Thank you

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