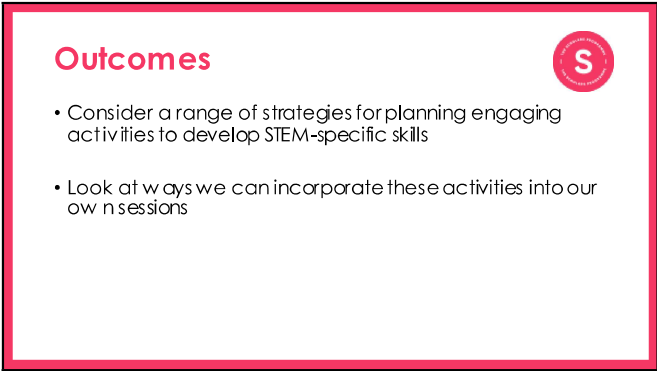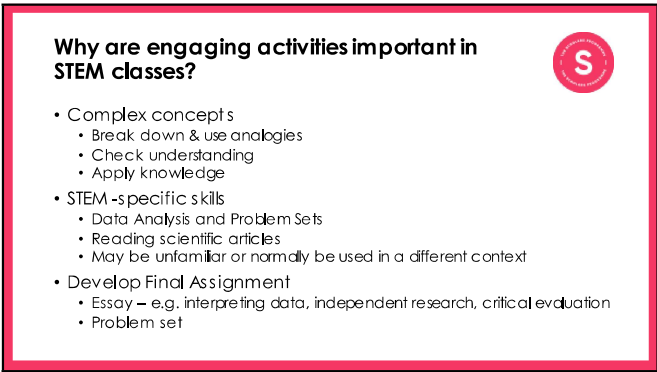**Engaging and Practical Activities**

for Building Skills in STEM

Presenter, Role

Outcomes

- Consider a range of strategies for planning engaging activities to develop STEM-specific skills

- Look at ways we can incorporate these activities into our own sessions

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Why are engaging activities important in STEM classes?

- Complex concepts
  - Break down & use analogies
  - Check understanding
  - Apply knowledge
- STEM-specific skills
  - Data Analysis and Problem Sets
  - Reading scientific articles
  - May be unfamiliar or normally be used in a different context
- Develop Final Assignment
  - Essay – e.g. interpreting data, independent research, critical evaluation
  - Problem set

We know why – now what makes it a good activity?

<u>Task</u>

- Brainstorm attributes of a "good activity"

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slido

What are the attributes of a good activity?

ⓘ Start presenting to display the poll results on this slide.

What makes a "good" activity?

- Clear aim
- Clear instructions
- Active participation
- Correct pitch + appropriate language
- Time limited
- Resources help learning
- Builds on previous skills/knowledge
- Links to other sessions

Planning and Delivering STEM Activities

Planning & Delivery

- Planning
  - Course planning
    - What skills are your students developing throughout?
    - What will be needed for the final assignment?
    - Do you want them to be able to breakdown scientific abstracts for independent research or complete a problem set?
  - Handbook
    - What information and resources will you need to include to support the above skills?
  - Session planning
    - Variety of activities
    - Chunking & linking across sessions the move advanced topics and complex information
- Delivery
  - Giving clear instructions – see core training sessions
  - Planning to adapt

What is the purpose of the activity?

- Clear activity outcome
- Relate to session learning objectives

- University-style learning
- Develop higher-level skills

- To stimulate interest?
- Determine prior knowledge?
- Introduce topic?
- Discover new knowledge?
- Consolidate knowledge?
- Practice skills?
- Test knowledge?

Engaging Starters and Plenaries in STEM

Starter:
- Understand students' baseline knowledge
- Identify students' misconceptions
- Get students to engage quickly with new content
- Recap previous content

What is a code?
Consider the above pictures and discuss the below questions:
- What is a code?
- Why do people use code?
- How would you break a code?
- How do people use code in the modern world?

Engaging Starters and Plenaries in STEM

Plenary:
- Students consolidate knowledge
- Reflect on what they have learnt
- Track students' progress
    E.g. Exit ticket post-its

Endless Possibilities...

- Pupil-led activities
- Self-discovery/Object-based enquiry
- Competitions
- Seminar-style discussions
- Role play
- Card sorts/Matching

Consider varying:
- Resources
- Group/ individual work
- Interaction
- Feedback
- Pacing
- Activity type

STEM can still have discussions and opinions…

Seminar-style discussions

Activity 3

To acknowledge changes in the people's behaviour due to technology, let's think about how people used to do simple daily activities in the past, and which devices, or tools they use to help them out during the activity.

Activity	What could help people to do this task 20 years ago?
To find an unknown address in a city that you've never been before	
To find a specific book title in the library	
To send a written message to someone in other city or country	

Activities can be used to test taught knowledge from a tutorial…

Card sorts/Matching

Task: Match the absorption spectra to the objects below.

Objects and discovery builds pupils inquisition…

Objective 2: To understand how light interacts with the body

Activity 1 – Using a microscope

For this activity, you will be provided with a small microscope and some prepared slides. Look at the slides with your 'naked eye' and also with the microscope. Choose one slide, and draw a picture of what you see with and without the microscope.

Naked Eye	With Microscope

Shine a torch through your hand. What can you see? What?

What can you not see? What?

How can medical engineers use this effect to measure your pulse rate?

Discussions can also take the form of role play…

But don't be afraid to work through problem sets….

- Most effective way for pupils to learn is some repetitive practice
- Pupils used to this from their lessons
- Scope for longer problem questions and group work to keep this varied
- I do – We do – You do structure

How will you use these? – Take home task

Choose one of these techniques. Plan how you could use this technique in one of your tutorials

Technique	Learning Objective	Resources needed	Feedback	Details
Card sort	Interpreting spectra	Prepared card sort	Cold-calling, pose pause pounce bounce	Pictures of different coloured objects and matching spectra printed on sheet. Pupils to draw lines matching the pictures to the spectra. Hinge point activity

Introducing Students to Scientific Papers

Introducing Scientific Papers

TASK:
Watch the following modelled activity

Think about these questions:
• What was aim/learning objective?
• Was this a good activity? Why?
• What could have been improved?

Scientific Papers

Perimortem fractures in Lucy suggest mortality from fall out of tall tree

John Kappelman, Richard A. Ketcham, Stephen Pearce, Lawrence Todd, Wiley Akins, Matthew W. Colbert, Mulugeta Feseha, Jessica A. Maisano & Adrienne Witzel

Nature **537**, 503–507(2016) | Cite this article

2099 Accesses | **35** Citations | **1868** Altmetric | Metrics

Abstract

The Pliocene fossil 'Lucy' (*Australopithecus afarensis*) was discovered in the Afar region of Ethiopia in 1974 and is among the oldest and most complete fossil hominin skeletons discovered. Here we propose, on the basis of close study of her skeleton, that her cause of death was a vertical deceleration event or impact following a fall from considerable height that produced compressive and hinge (greenstick) fractures in multiple skeletal elements. Impacts that are so severe as to cause concomitant fractures usually also damage internal organs; together, these injuries are hypothesized to have caused her death. Lucy has been at the centre of a vigorous debate about the role, if any, of arboreal locomotion in early human evolution. It is therefore ironic that her death can be attributed to injuries resulting from a fall, probably out of a tall tree, thus offering unusual evidence for the presence of arborealism in this species.

5:00

• What do we know about this individual?
• What do we know about the species?
• What new information have these researchers discovered?

Summary and Take Home Task

Summary: Checklist

- ✓ Clear & achievable objective
- ✓ Supports course aims
- ✓ Correct pitch
- ✓ Active engagement
- ✓ Time limited
- ✓ Resources aid learning
- ✓ Clear instructions

Summary: Guided questions

- Purpose of activity
  - Learning objective?
  - Learning new knowledge/skills or applying known knowledge/skills?
  - How does this fit into aims for session/course?
  - Does format of activity work towards session/course aims?
- Content
  - Pitched well for target audience?
  - Vocabulary appropriate for target audience?
- Course planning
  - Link to other sessions?
  - Building to final assignment? Problem set? (How will you build these skills?)
  - Established required knowledge/skill base in advance of activity?

Summary: Guided questions

- Type of activity
  - Best activity to achieve objective?
  - Variety of activities in class/course?
- Time
  - Time needed? Fits appropriately within session? Need time to explain/model?
  - What could cut from session? Extension exercise?
  - Vary pacing in session?
- Resources
  - Support learning?
  - Easily available to students?

Take Home Task

TASK

• Pick and objective from one of your tutorials

• Think of some different ways you could deliver this and how you can check pupils knowledge using an activity

• Develop the activity using checklist/guided questions

The Scholars Programme

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