Physical Geography Special Interest Group

Exploring exciting ways to teach

Water, Air, Land & Life

'Physical impact – sudden or slow?'

Conference Workshop – Manchester 2015

Exploring approaches that tackle the tricky idea of how timescales affect landscapes and environments plus approaches to looking for evidence of the short and long term impact of physical processes. These key concepts/skills are fundamental to students' appreciation of effective decision-making in issues linked to physical environments.

Activity 1: *How does Mt Etna help to tell the time?*

How Charles Lyell worked out a 'secret' of the volcano and what it told us about 'deep time' and how to work out how long it takes to form physical landscapes: an exercise using simple numeracy.

Presenters: ***Duncan Hawley & John Lyon***

Many students live in the 'fast lane' and so struggle to grasp or don't even think about the timescales over which physical geography processes operate. However, grasping the timescale and the rate at which landscapes take to form helps students appreciate how the natural world operates on a different level of timescale, which can put physical geography processes into context and perspective, whether a volcanic eruption or plate subduction, the uplift of mountains or the weathering of mountains. This activity sets out a way of allowing students to emulate an early attempt to determine the age of rocks and landform features using simple reasoning, a quantitative method and basic numeracy calculation.

Aims:

(a) to consider timescales of landscape formation and change.
(b) to appreciate the ways 'deep' timescales (beyond the memory of people) are worked out and constructed
(c) to understand how reasoning and quantitative methods can develop

Resources

(a) Image of Mt Etna
(b) Post it notes
(c) Role play 'My name is…'.sheets and face masks (William Smith and Georges Cuvier - and Charles Lyell)
(d) Calculators: hand-held or via apps for tablets, ipads or smartphones
(e) Questions worksheet
(f) Geological time scale sheets (download/hard copy order from www.keele.ac.uk/gge/resourcesforeducation/geologicaltimescale/)

Method

1. Arrange students in pairs or small groups.
2. Introduce using an image of Mt Etna.
3. Ask students to suggest how old it is since the first eruption and write suggestions (in years) on post-it note. Ask students to discuss how they know – what evidence did they/could they use to work out the age.
4. Post suggestions on board and review the range and select some students to outline their method (if they have one).
5. Give out a copy of the illustration showing the simple rock sequence with fossils. Select two students to role-play William Smith and Georges Cuvier using the face masks to read out their discoveries. Ask students to formulate the important question that still needs to be answered. Write the question on the board – "How long was the time involved in the formation of the whole sequence of rocks?"
6. Introduce Charles Lyell. Announce he set himself the puzzle and outline the method for solving it. Give the dimensions of Mount Etna and the average rate and volume of eruptions.
7. Students follow the working of Charles Lyell by answering the set Questions using calculators.
8. Get students' to share their conclusions from Q7.
9. Read out Lyell's conclusions (in role?) and the significant consequence of his 'proof' of time.
10. Finally, display or hand out of the current geological timescale. In pairs/small groups students discuss and decide what they have realised about the formation of landscapes.
11. Display an image of a landscape/landform. Ask how they might think about the landform differently now.

Teaching Points

- Role-playing real characters from the history of physical geography and how they argued/reasoned through knowledge is a powerful way of introducing tricky concepts and helps understand that our knowledge is not final!
- The post-it activity will likely reveal that students have a wide range of ideas about the age of landforms – even familiar ones like volcanoes – and even less knowledge about how the age of a landforms is determined.
- Announce Charles Lyell as a real rock celebrity (you could role play). Lyell's book (The Principles of Geology) was a runaway bestseller of the 19th century - running into 12 editions and series of shorter versions in Britain, Europe and the U.S.A. - more than a modern-day Harry Potter book. As a scientist he was the Professor Brian Cox of his day!
- The introductory worksheet is best produced in colour for impact – so laminate!
- Calculations (and reasoning) can be modeled on the IWB if students need assistance.
- When concluding - emphasise that Lyell's calculation was not accurate although he was on the right track and it led the way to calculating rather than guessing the age of landforms. An accurate timescale only came about with discovery of radioactive decay used as an atomic clock in the first half of the 20th century. For more information read 'The Dating Game: One Man's search fro the age of the earth' by Cherry Lewis, published by Cambridge University Press).
- Challenge students to suggest the timescales of formation and/or the age for a range of physical features. If students can identify evidence of recent activity (weathering, erosion, deposition, encourage students to think how many times these must happen to create the landform. This can lead to discussions about whether frequency and magnitude, and how these might be measured.

Application

- This activity makes for a great introduction to looking at geological timescales, for considering the impacts of weathering/erosion/deposition processes (for how long do they need to operate to 'wear the land down?) – or as a way of thinking about fast and slow processes and their impact on the landscape.