What I've learned from teaching geoscience in prison

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A science course in prison

***Think Like A Scientist* is a course for those interested in science and nature – taught inside prisons in the UK.** Over seven weeks, students learn about different topics (as outlined below). However, instead of focusing on gaining knowledge of the subjects, the students are guided to 'think like a scientist' – in particular, to see where the limits of our understanding are and to pick apart issues surrounding research methodology. In a world where **'fake news'** is present, the course helps students through mental training. The students are encouraged to **voice their opinions** on topics and be prepared to **fail** in the pursuit of knowledge.

The course focuses on three pillars of being a scientist: **understanding** the research; **analysis** of what we know, what we don't know and what we need to know; and the **communication** of our findings.

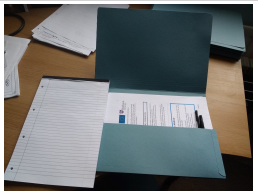
This poster outlines the first trial run of the course – it's development has been greatly helped by the Inside-Out training program at Durham University (Dr Hannah King), and Cell Block Science in Scotland (Dr Mhairi Stewart, University of St Andrews).

The scientific topics covered

Week 1 *The Science of Sleep (health and wellbeing)*
Week 2 *The Atmosphere (climate change, air quality)*
Week 3 *Geoscience (earthquakes, volcanoes, plate tectonics)*
Week 4 *Space Missions (Mars and beyond)*
Week 5 *The Universe (what is left to discover)*
Week 6 **Guest Speaker* - Robots (Prof Danielle George)*
Week 7 *Final presentations and round-up*

Weekly setup:

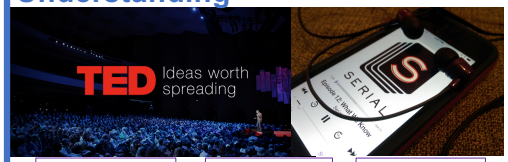
Understanding: We learned about a science topic each week.
Analysing: We studied an article & applied scientific thinking.
Communicating: We learn how to present ideas to others.



Each student recieved pens, paper, and a folder to hold the weekly print outs (left). The first course was taught in early 2019 at HMP Low Newton (a women's prison in the north-east of England). The class plan followed the outline in the table below - each class lasted 2.5 hours and included a coffee break. The only teaching aid, aside from paper handouts, was a paper flip.

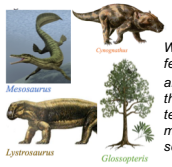
Time	Activity
Arrive at 8:00 am	
8:45 – 9:00 am	Discussion of previous week
9:00 – 9:15 am	What is [main topic]?
9:15 – 9:30 am	Topic 1
9:30 – 9:45 am	Discussion
9:45 – 10:00 am	Topic 2
10:00 – 10:15 am	**Coffee break**
10:15 – 10:30 am	Topic 3
10:30 – 10:45 am	Discussion
10:45 – 11:00 am	Topic 4
11:00 – 11:15 am	Wrap up & homework description
Leave at 11:30 am	

Understanding



[ACCESSIBILE] [ENGAGING] [NARRATIVE]

The course wanted to stay away from traditional classroom settings – many of the students have negative connections with their early learning in high school. The information presented here was mainly given in the style of TED talks and podcasts – interesting 15 minute segments of science which are accessible and have a narrative (however, only using paper handouts and no powerpoint). Four of these 'TED' style talks are presented during a class (shown by Topics in the planning table below). For the geoscience week, topic 1 covered plate tectonics/supercontinents/fossils, topic 2 covered volcanoes, topic 3 earthquakes, and topic 4 showed case studies of major volcanoes and earthquakes.



Week 3 handouts featured Pangea and the fossils that brought plate tectonics into mainstream scientific thinking

Analysis

The students learn how to analyse – we do this through using the scientific method to dissect current research. In particular, we take articles from The Conversation (a website where academics present accessible, journalistic versions of their research – examples below) and see what we didn't understand and where we think the study could be improved. The text to the right highlights what questions the students should be asking – they are asked to write no more than two pages on the articles and told not to be afraid to give their opinions on where the study can be improved. The students adapted to this very well & gave a fresh perspective on the articles.

THE CONVERSATION
Academic rigour, journalistic flair

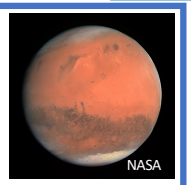
THE CONVERSATION

Connecting animals to the cloud could help predict earthquakes

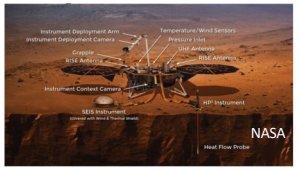
- What was the question the reading was asking?
- What did you originally think about it?
- What did they do to study the question?
- What did they find out?
- Is this surprising?
- What are they missing?
- Are you sceptical? What are you sceptical of?
- What didn't you understand?
- What questions would you ask?
- What else would you like to know?
- How do you think we could find this out?

Communication

Communication is a major part of being a scientist. The course helps the students with their **confidence** in communication. Each week, the students present written ideas on the science topics covered (as described in the Analysis section). A really great example of communication in action was during Week 4's homework on Mars. The students were asked to write their first email home from Mars where they had been stationed on a science mission (e.g., Insight – as shown to the right).



This homework was originally developed in the 'Life Beyond – From Prison to Mars' book by Prof Charles Cockell. Below is an excerpt from one of the student's emails – note the mix of art of science as the student communicates the subtle nature of Mars between the normality of space missions.



Hi Mum, this is my first message from the surface of Mars!

We landed early this morning and set foot on the planet in time to see the sun rise over our new home. The day has been busy, setting up the habitat and ensuring there were no leaks was our priority. It should be pressurized by the morning then the moving over of all the gear and supplies can be completed.

I was grateful that the gravity here is just one third of the Earth's as some of the loads were quite large and surprisingly heavy. It is strange to have weight again after 9 months of weightlessness. The surface is very dry and the boots of our EVA suits kick up quite a lot of dust. I can see that being a problem for the airlock filters.

The stars here don't twinkle as they do on Earth, this is due to the thin atmosphere. There are two moons in the sky and I am looking forward to pointing our telescope towards them tomorrow. We have landed and set up our home near a cliff face which looks to be made up of layers of sedimentary rocks streaked with black and white, possibly basalt and gypsum, with the overall colours ranging through white to orange-red with an occasional flash of either haematite or iron oxide. Pete and Dave our geologists can't wait to get out and take samples. Mars' 25 hour day gives us an average of 40 minutes more light.

The solar panels are connected, and the comms system set up although the satellite dish took all of us to open as it had stuck shut in transit. The problem proved to be a trapped wire. Emma reckons the vibration moved it. Well Mum, Emma says if I send this now you'll get it quicker as we are in line of sight with Earth for the next hour.

Write soon. Love, Sheila. X

In week 7, the students take over the teaching and present their final presentations. At HMP Low Newton, the students all picked a British scientist who may feature on the new £50 note – a competition which is run by the Bank of England. The students pitched their person as the new face of the note – the instructions below encouraged them to be **bold**.

The students bought into this task and presented wonderfully with limited resources. After a class vote, Alan Turing was declared our nomination for the £50 note.

Preparation and Suggestions:
Presentations should include:

SET say 'hello' : who you are : introduction, objectives, outline, setting the mood: *what are you going to tell 'em*
BODY content and themes: cover the points introducing each one: signal important ones: *tell 'em.*
CLOSURE review and wrap-up: *tell 'em what you told them*: summarize: finish strongly, with a full stop

- This is a unique opportunity for you to experiment with your teaching/presentation/communication style. I urge you to push your limits a little beyond your normal comfort zone - experiment with some styles or techniques. This is about your learning, not about producing a "perfect" presentation. Have some fun!

Challenges

- An important aspect of prison teaching is to ensure **consistency** each week – trust needs to be earned in the classroom.
- **Inclusivity** of all students is important at all times – no student can be left behind.
- The students will have varied educational abilities - classes need to be **accessible and engaging**.
- There is **no access to the internet** at any point for the students and as an educator once in prison.
- Prison education is a **highly restricted learning environment**.

What I've learned:

- In setting up this class, **I learned to listen** to feedback carefully. All input from prison educators and current inmates was invaluable.
- **I learned to detach from ideas!** I had come up with many great ways of teaching and learning, but they didn't quite fit the environment. I held onto them for too long in the preparation, but they had to be binned.
- Through having to focus on what the students can get from the class, I have become focused on the question **"what is it exactly that I am trying to teach?"** In this class it was a way of thinking and to try to build confidence so the course can be a **pathway to other education opportunities.**
- I learned that **the students were the most dedicated and willing that I've ever had** in my 11 years of teaching.
- I learned that if we can teach science in prison, **we can teach anywhere** where people want to be taught.

The "Impact" factor

- In grant applications, funding agencies demand that we are impactful with our science
- Can we be more useful to our wider community when doing outreach?
- Should we expand our portfolio of outreach away from classrooms and science fairs?

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