Using inquiry-based exercises to engage first-year geoscience students

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Why inquiry-based learning?

- Interested in increasing student engagement
- Active learning
- Worried about lack of content retention
- Link with world outside university

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inquiry-based learning

problem-solving skills

active learning

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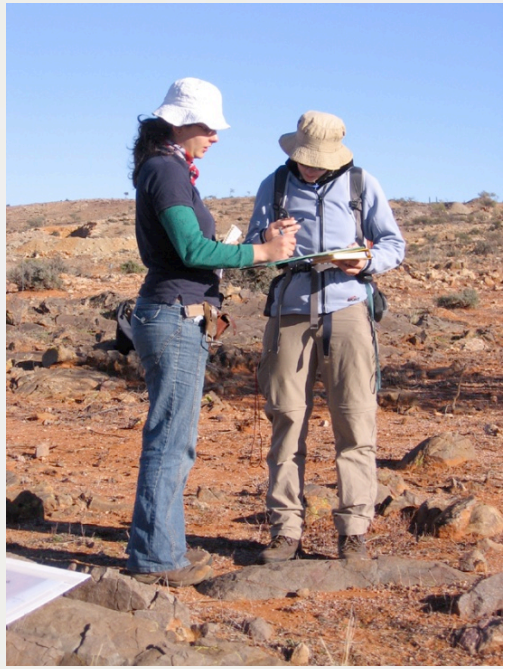

tailored problem-based learning

format suited to first year (most likely more familiar with teacher-directed learning)

Theresa Winchester-Seeto

real world research and industry experiences

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Tailored Problem-based learning

- Extended problems that are based on realistic scenarios
- Fairly structured in first year
- Support reduced gradually as the student progresses through their program

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Tailored Problem-based learning

- an effective way to involve students in an active-learning environment
- instill the principles of scientific research
- incorporate generic skills into the curriculum

The context

- Department offers a three-year degree with a fourth honours year
- Flexible degree program with multiple pathways into a program
- Students' prior knowledge and skills base can be varied
- Range of academic ability
- Introduced into single units

- students work in groups of ~ 5
  - cooperative efforts in small groups benefit weaker students
  - all benefit from increased engagement with the content

What were the best aspects of the ***unit***?

group work.
It is the only subject here you get to discuss ideas in a group & come up with team dissions which is important because it is how the real world works. I think it develops important skills.

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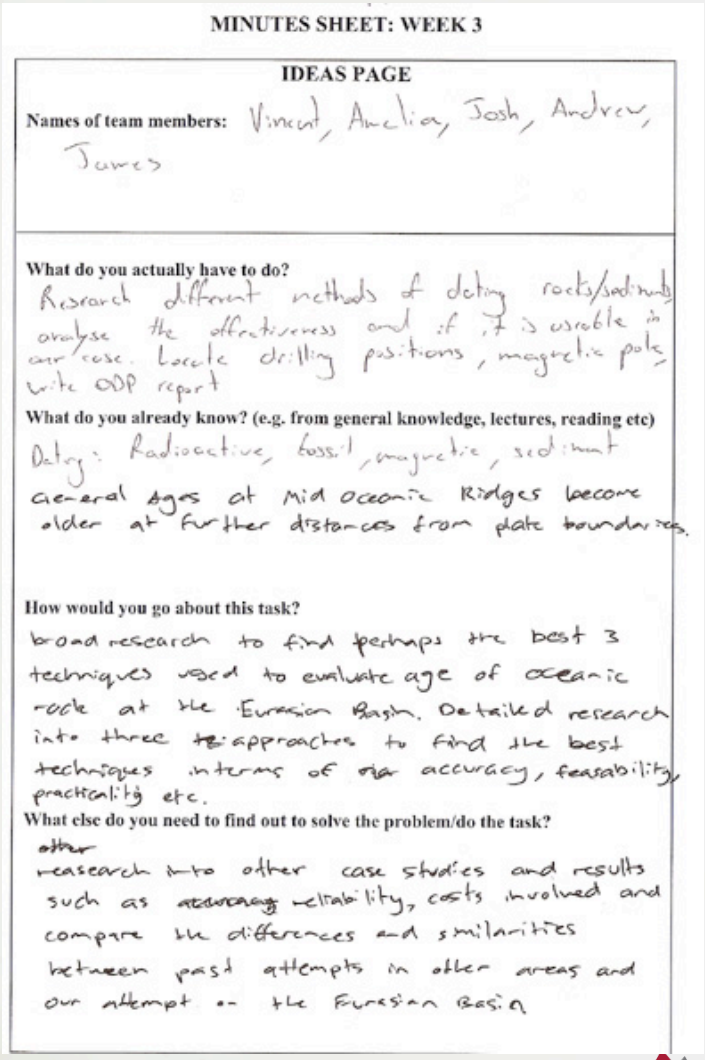
Format

- each problem extends over 2-3 weeks
  - Supported in first year by minutes sheets
  - Clarify the problem
  - Plan what to cover
  - Record what is completed



MINUTES SHEET: WEEK 3

IDEAS PAGE

Names of team members: Vincent, Amelia, Josh, Andrew, James

What do you actually have to do?

Research different methods of dating rocks/sediments, analyse the effectiveness and if it is useable in our case. Locate drilling positions, magnetic pole, write ODP report

What do you already know? (e.g. from general knowledge, lectures, reading etc)

Dating: Radioactive, fossil, magnetic, sediment

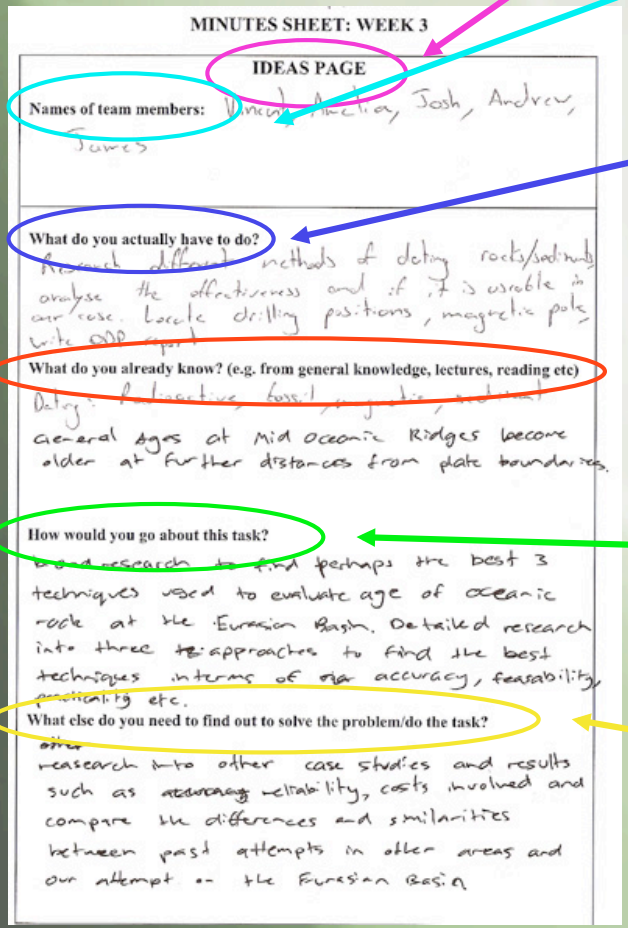
General ages at Mid oceanic Ridges become older at further distances from plate boundaries.

How would you go about this task?

broad research to find perhaps the best 3 techniques used to evaluate age of oceanic rock at the Eurasian Basin. Detailed research into three approaches to find the best techniques in terms of its accuracy, feasability, practicality etc.

What else do you need to find out to solve the problem/do the task?

other research into other case studies and results such as reliability, costs involved and compare the differences and similarities between past attempts in other areas and our attempt at the Eurasian Basin



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What do you already know?

How would you go about this task?

What do you need to find out to solve the problem/do the task?

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Format

- supported by a lecture series
- “fact sheets”
- give background to the problem
- help to focus the direction the students take
- tutor facilitates each class

Format

- place the students in the role of a geoscientist with topics that they might encounter in industry or a research role

The case studies – allowed me to understand the sort of work I would be doing in the feild if I continued with this subject.

Your task

The federal government has become concerned following reports regarding the possibility of eruptions of volcanoes in south eastern Australia and has decided to assess the risk of eruption of volcanoes occurring in chains from Queensland to western Victoria.

Geoscience Australia has been asked to investigate and document the younger Australian volcanoes and to compare them to active volcanoes in other parts of the world. Your team has been asked to produce a report on the young volcanoes of south eastern Australia and to make the dangers clear to politicians. You should find a similar eruption that has occurred elsewhere in the world in historic times and describe the eruption and the hazards that it generated. The report will be presented to politicians and public sector workers and needs to include basic information about volcanoes.

Example - Port Hacking project

- Problems designed around the collection of sediment samples during a boat trip
- cover a range of key concepts
  - identification of sediment types
  - particle transport processes
  - environments of deposition
  - distribution of micro-organisms

Example - Port Hacking project

- Students need to choose sample sites for a research cruise and then analyse the samples when back in the classroom

Example - Port Hacking project

- Skills:
  - plan a reconnaissance sampling program
  - collect samples and chemical data
  - analyse the sediment using a variety of techniques
  - present data using appropriate graphs and tables
  - report writing for a specific audience

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Benefits

- The use of “real” problems helps to engage students with the content and complete the problems with enthusiasm

What were the best aspects of the ***unit***?

I really enjoyed the guest lectures and the Volcanoes Case Study.

Benefits

- Weaker students perform better
- Top students still do well
- Improve their generic skills

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Benefits

Examples of student comments:

“good, challenging, fun – heaps different to other courses”

[Best aspects] *"Group work enhanced learning process and it was fun.”*

“The group work and how we were engineered to meet people and work closely with them to solve our Project.”

"Using my problem solving skills to work out difficult tasks.”

“working at our own pace and not being spoonfed the whole day”

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Wrap-up

- Tailored problem-based learning leads to better student engagement
- Instills generic skills
  - Group work
  - Problem solving skills
  - Critical thinking
- Content retained

- Introduced into single units rather than the whole course due to flexible nature of the program