



Fostering & Measuring General Scientific Reasoning Expertise of 2nd Year Students

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### **Project Outline**

Define nature of expertise [4 refs] →

Focus on *scientific* expertise [12 refs] →

Design / implement / test corresponding pedagogy →

Measure (assess) students' improving abilities → *Iterate.*

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### **The Course: EOSC212**

#### ***Topics in Earth and planetary sciences***

13-week, 2<sup>nd</sup> year course designed to:

- Foster generic scientific skills while exploring 3-4 Earth and planetary science topics.
- Pedagogy and assessment based on experience and literature on expertise & science expertise.

#### **Classroom practices**

- team-based learning strategies,
- replace exams with quizzes and projects,
- mix team-teaching with solo-teaching,
- discursive rather than didactic instruction,
- use of diverse, Department-specific topics.

#### **Assessment practices**

- individual / team quizzes
- weekly abstract writing
- weekly assessed questioning
- team-based data analysis exercises
- pre-post testing of model based reasoning
- Poster & presentations (students choose topics)
- Peer assessment of posters & presentations

#### **Data & results of using strategies (3 terms)**

- Abstract writing skills improved then plateaued.
- Thinking with (& about) models/data improves.
- Questions posed ...

- depend on article type.
- become more articulate.
- become more insightful, less about content.
- Surveys showed students appreciate
- topics
- team work
- practicing communication & peer assessment
- the discussion orientation

#### **Continuing challenges**

- Assessment of question type and quality
- Use of question-posing as a measure of expertise

#### **Conclusion** (*Lessons Learned*)

**Improving science thinking expertise involves explicit guidance in aspects involving judgments and metacognition.**

For EOSC212 these are

- Synthesis of new knowledge (abstract writing);
- Posing questions of various (& relevant) types;
- Appropriate use of 'models' & 'data' in discussion;
- Communication (written, oral and poster);
- Assessment of peers' work & thinking.

*References listed on reverse.*

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