Strategies for Confronting Preservice Elementary Teachers' Alternate Conceptions

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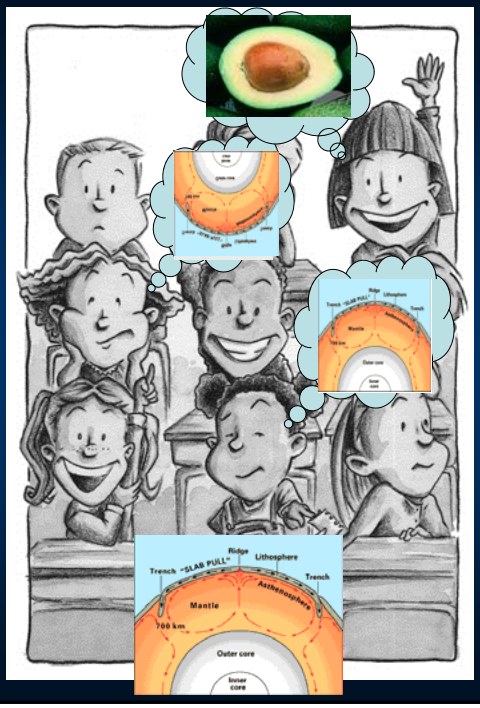


ALTERNATE CONCEPTIONS

- Learning builds on prior knowledge
- Many "alternate conceptions" are deeply entrenched
- Future teachers may propagate alternate conceptions to their students

http://picture-book.com/files/userimages /43u/classroom.jpg

PURPOSE

MY EXPERIENCE

- Seven years teaching earth science content course for future elementary teachers
- Develop strategies to confront (and change) alternate conceptions
- Evaluate success of the course using 15-item GCI

STRATEGIES EMPLOYED

- Elicit alternate conceptions prior to each lesson, discuss, and revisit
- Reflect on what alternate conceptions children hold about each topic, assess
- Semester project
  - Research common alternate conceptions about a topic
  - Interview a child about their ideas
  - Develop an inquiry lesson to address alternate conceptions

EXPLORING GEOLOGY

THE COURSE:

- Exploring Earth Science: Geology
- One of six content courses for preservice elementary (K-8) teachers
- Two, 2-hr and 20-min sessions per week
- Integrated lab, discussion, brief lecture
- Limited to 24 students
- Inquiry (structured/guided)

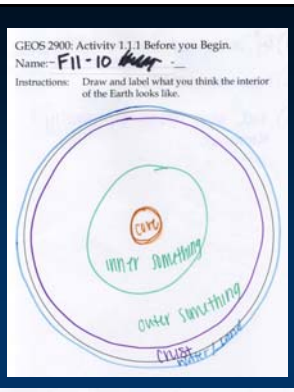
STUDENTS

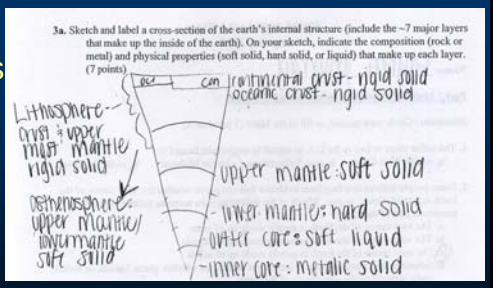
- 81% Female
- 93% White
- Mean age 21.7

IN EACH LESSON

ELICIT AND ADDRESS ALTERNATE CONCEPTIONS:

- Lessons loosely based on the 5-E* format
- Engage: "BYB" questions
  - Elicit prior knowledge and alternate conceptions
- Explain: "Outcomes"
  - Revisit main BYB ideas





*BSCS (1989). New Designs for Elementary Science and Health: A Cooperative Project between Biological Sciences Curriculum Study (BSCS) and International Business Machines (IBM). Dubuque, IA: Kendall/Hunt Publishing Company.

REFLECT AND ASSESS

EXPLAIN CHILDRENS' ALTERNATE CONCEPTIONS:

- Questions in lessons

3.2.1 THE POWER OF ICE

5. A common misconception among children is that when a glacier retreats, the ice is actually moving backwards (uphill). Explain why this cannot be true, and explain how a glacier can retreat while the ice is still moving forward (downhill).

- Questions on exams

UNIT 1 EXAM

6. Describe two common misconceptions that children often hold about plate tectonics, earthquakes, or volcanoes. Explain why each is a misconception. (4 points)

SEMESTER PROJECT

THE MISCONCEPTIONS LESSON PROJECT

In this project, you will:

1. Select a topic in earth science that is part of the Earth Science Michigan Grade Level Content Expectations for grades K-8. This should be topic that you currently know very little about, or would not yet feel comfortable teaching.

2. Read or learn about the topic in order to demonstrate a mature (adult) understanding of this topic.

3. Research, using Web and library sources, what ideas children hold about this topic.

4. Talk to a child or group of children to find out what ideas they hold and the reasons for their ideas.

SEMESTER PROJECT

THE MISCONCEPTIONS LESSON PROJECT

In this project, you will:

5. Design a lesson plan that (1) demonstrates an awareness of alternate conceptions children commonly hold about your chosen topic, (2) encourages learners to change their misconceptions, and (3) evaluates whether your lesson has been successful in changing students' ideas.

6. Present the findings of your research and a demonstration of your lesson plan to the class.

7. Evaluate your peers' presentations and your partner's contribution to the project.

SEMESTER PROJECT

THE MISCONCEPTIONS LESSON PROJECT - GRADING

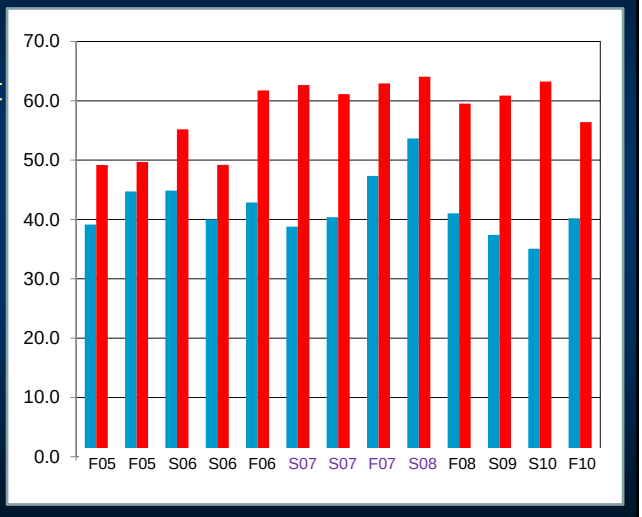
REPORT/LESSON			
Demonstrates a correct, adult-level understanding (3 points)	Understanding of the topic has minor errors or omissions (2 points)	Understanding of the topic is incomplete or not adult-level (1 point)	Understanding of the topic is incorrect (0 points)
One or more studies describing children's ideas about the topic are described (3 points)	One or more studies are mentioned but findings are not described (2 points)	Misconception is discussed but not linked to a specific research study (1 point)	No studies are described or mentioned (0 points)
Describes how the lesson addresses children's ideas and misconceptions (3 points)	Describes how the lesson addresses children's ideas but not misconceptions (3 points)	Describes how the lesson corrects misconceptions but not addresses children's ideas (3 points)	Does not describe how the lesson addresses ideas or corrects misconceptions (0 points)
Lesson solicits student ideas about the topic prior to instruction (3 points)	Lesson introduces facts or vocabulary prior to engaging students in the activity (2 points)	Lesson opening is inappropriate to find out student misconception (1 point)	Lesson makes no attempt to find out student ideas prior to instruction (0 points)
Assessment evaluates learning outcomes and is linked to the misconception (3 points)	Assessment evaluates learning outcomes but is not consistent with the misconception (2 points)	Assessment is not appropriate to determine learning outcomes (1 point)	No assessment provided (0 points)

IS IT WORKING?

COURSE ASSESED WITH GCI

- 15-item version of the GCI (1.0)
- Administered as a stand-along pretest
- Questions embedded in relevant exams

- 10 semesters, 13 course sections, 3 instructors (N=~250)
- Mean raw gain of 16.2% (range 5.0-28.2%)



CONCLUSIONS

WHY DOES THIS “WORK”?

- Students need multiple, explicit opportunities to engage with alternate conceptions
  - Make explicit discussion of alternate conceptions a part of each lesson
  - Assess for knowledge of alternate conceptions

- Need a classroom culture in which it is OK to be “wrong”
  - Explain the purpose of BYB
  - Cast in terms of children’s ideas
  - Be persistent!

Thank you: GEOS 2900 students, David W. Rudge, Jeff Barney, Caitlin Callahan, Matthew Ludwig, Kate Rowbotham