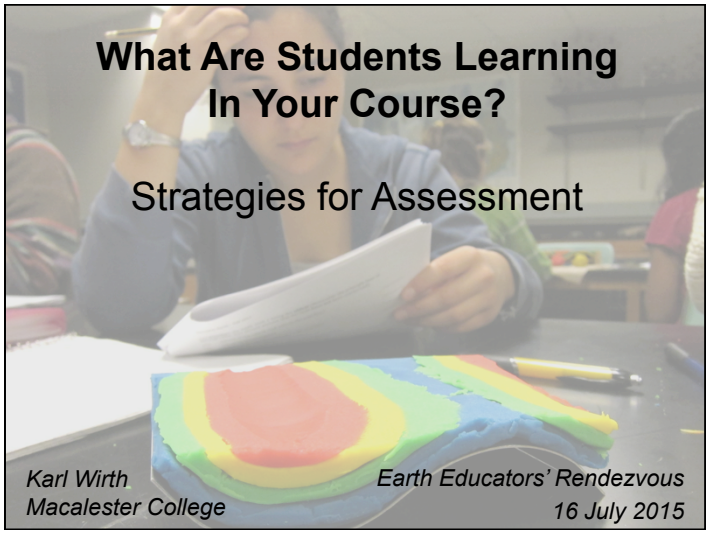


Purposes of Assessment

- design effective learning experiences
- track student progress
- focus student effort
- provide feedback for improved learning
- assign grades
- improve instruction
- improvement of programs and curricula
- personnel review
- accreditation of institutions and programs

Knowledge Dimension

Factual Knowledge
- Terminology
- Specific details and elements

Conceptual Knowledge
- Classifications and categories
- Principles and generalizations
- Theories, models and structures

Procedural Knowledge
- Subject-specific skills and algorithms
- Subject-specific techniques and methods
- Criteria for determining when to use procedures

Metacognitive Knowledge
- Strategic knowledge
- Cognitive tasks, incl. context and conditional knowledge
- Self-knowledge

What Employers Want From Higher Ed

- Teamwork
- Critical Thinking and Reasoning
- Oral and Written Communication
- Ability to Locate and Use Information
- Self-Knowledge
- Global Knowledge
- Application of Knowledge & Problem-Solving

Results of AAC&U Employer Survey

The US Department of Labor estimates that today's learner will have 10-14 jobs…

by the age of

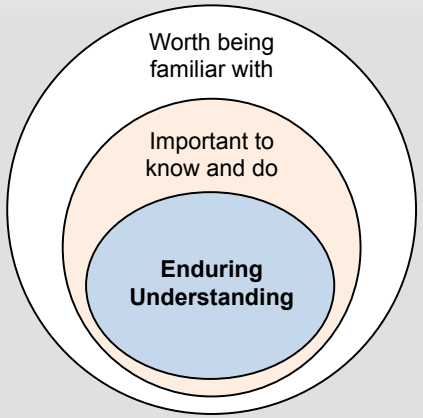
38

Approaches to Course Design

"Traditional"	"Backward"
List Course Topics	Enduring Understandings and Learning Goals
Design Instruction	Acceptable Evidence
Prepare Exams/Papers	Instructional Activities

Wiggins and McTighe (1998)

Establishing Curricular Priorities



Wiggins and McTighe (1998)

Example Goals for Learning

Students graduating with a degree should:

- Recognize common rocks and minerals in hand sample and thin section.
- Read topographic and geological maps and airphotos.
- Make and analyze geological and geophysical measurement and interpret geological features in the field
- Understand the origin, structure and history of the Earth and how the Earth System works

Articulating Learning Outcomes

- **Learning outcomes are more specific than goals**
- **Learning outcomes** are concrete examples of how students can **demonstrate** or indicate their mastery of the desired knowledge, skill, or value. *Maki (2004)*
- **By the end of this course, students will be able to…**

Goals vs. Outcomes Example

Institutional Writing Goal	Learning Outcomes
Students should express themselves well in written forms.	**Students will be able to:** • Construct an argument • Organize an essay • Use argumentation and evidence to support claims • Demonstrate clarity, proper grammar, usage, and style in academic writing, etc.

Characteristics of Good Outcomes

- Describe desired learning within a context
- Rely on active verbs (e.g., analyze, create, compose, calculate, construct, evaluate)
- Can be assessed quantitatively or qualitatively

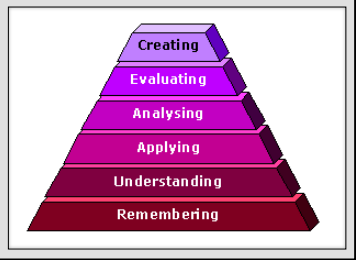
Maki (2004)

Learning Outcomes

- put focus on student learning
- inform students about faculty intentions
- guide instructional design
- result in "deeper" learning
- focus on skills and abilities that are central to the discipline; these generally endure

Knowledge Surveys

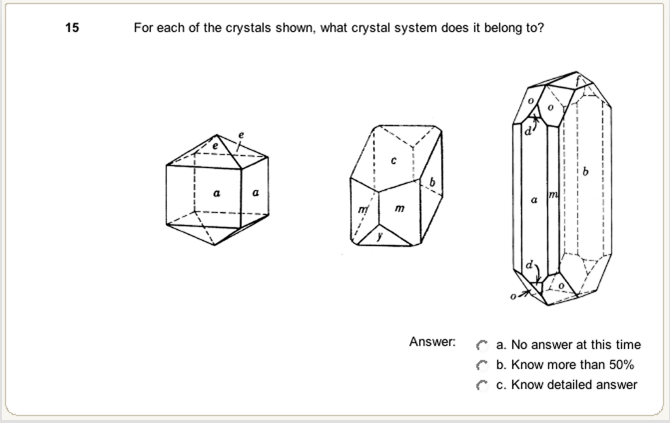
- Introduced by Nuhfer (1993, 1996)
- Knowledge & skill outcomes of course
- Span levels of thinking (Bloom levels)
- Students self-report knowledge/ability



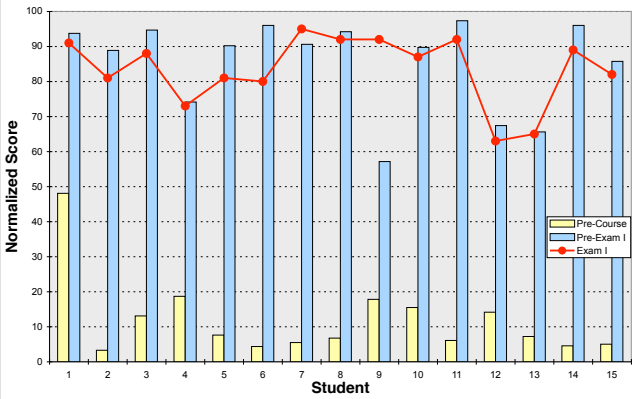
Example Survey Items

Items	Level
I can provide the definition of a mineral.	**Remember**
I can describe the cooling of a basaltic magma using Bowen's Reaction Series.	**Understand**
I can calculate the relief of a region using a map.	**Apply**
I can compare the generation of melts along convergent and divergent plate boundaries.	**Analyze**
I can evaluate three potential sites for a landfill.	**Evaluate**
I can construct a model of the origin of a suite of rocks formed from an intrusion.	**Create**

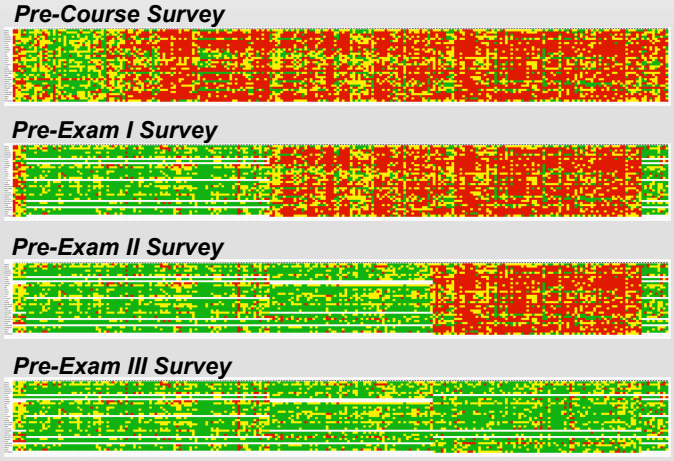
Survey Items



Knowledge Survey & Exam Results



"Map" of Learning for Dynamic Earth



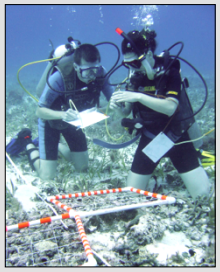
Utility of Knowledge Surveys

Course Design
- Clarification of course objectives and structure
- Improved organization and preparation

Students
- Full disclosure of course objectives and expectations
- Study guide
- Formative assessment tool
- Development of self-assessment skills

Instructors
- Assessment of learning gains
- Course assessment
- Assessment of instructional practices

Programs
- Program Objectives
- Student Learning



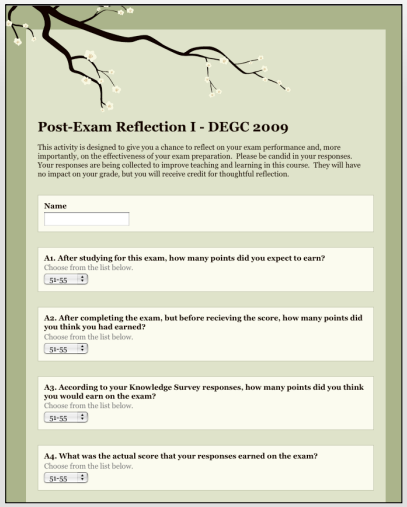
Bloom's Cognitive Processes

Level	Definition	Verb Examples That Can Represent Intellectual Activity
Create	Originate, integrate, or combine ideas into a new product or plan	arrange, assemble, compose, construct, create, design, develop, formulate, organize, propose
Evaluate	Appraise, assess, or critique on basis of standards or criteria	appraise, argue, assess, attach, choose, defend, estimate, judge, predict, rate, select, evaluate
Analyze	Distinguish, classify, or relate assumption, hypotheses or evidence	analyze, appraise, categorize, compare, distinguish, examine
Apply	Select, transfer, and use data or principles to complete new task	apply, choose, demonstrate, employ, illustrate, interpret, solve, use
Understand	Translate, comprehend, or interpret information	classify, describe, discuss, explain, indicate, restate, translate
Remember	Recall or recognition of information, ideas and principles	arrange, define, label, list, name, relate, recall, repeat, reproduce

Exam "Wrapper"

- Self Evaluation
- Preparation Strategies
- Performance Analysis
- Planning
- Revision

Achacoso (2004)
Lovett (2008)



Post-Exam Reflection I - DEGC 2009

This activity is designed to give you a chance to reflect on your exam performance and, more importantly, on the effectiveness of your exam preparation. Please be candid in your responses. Your responses are being collected to improve teaching and learning in this course. They will have no impact on your grade, but you will receive credit for thoughtful reflection.

Name

A1. After studying for this exam, how many points did you expect to earn?
Choose from the list below.
51-55

A2. After completing the exam, but before recieving the score, how many points did you think you had earned?
Choose from the list below.
51-55

A3. According to your Knowledge Survey responses, how many points did you think you would earn on the exam?
Choose from the list below.
51-55

A4. What was the actual score that your responses earned on the exam?
Choose from the list below.
51-55

Exam I Revisior Name:

Be sure to complete the field in both columns for each question that you would like to have re-graded. Hand in sheets with diagrams separately (don't forget to put your name on them). ***DO NOT DELETE UNUSED ROWS.***

Use Command+Option+Return keys (use Alt+Enter on a PC) to enter a line break within a cell.

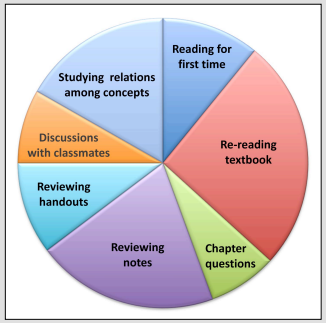
To autmatically adjust cell height to accomodate your text, Double-Click lines between rows at the far left.

This file gets uploaded to Moodle. Submit all maps and diagrams, in order, labeled with question number, and Last Name in class.

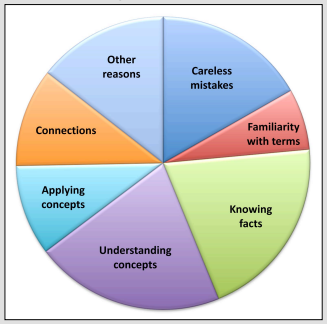
Section/Quest	I originally thought the answer was.... but now I understand this is incorrect because....	A better answer is.... because....
I. Matching		
1	I originally thought the answer was b. "formed by chemical precipitation", but now I understand that the lithosphere is part of the mantle, so can not be precipitated	A better answer is h. "behaves like a rigid solid" because the lithosphere is composed of crust and upper mantle that is cold and rigid, hence "litho" as in stone.
2		
3		
4		
5		

Exam "Wrapper" Results

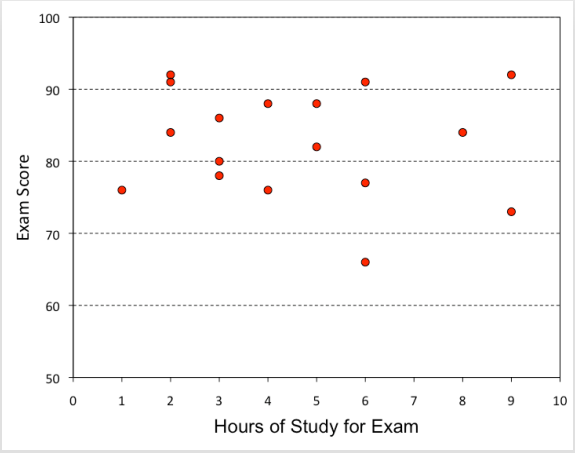
Study Strategies



Analysis of Errors



Exam Preparation



Next Generation Science Standards

Three Dimensions of the NGSS Framework:

- Scientific and Engineering Practices
- Crosscutting Concepts
- Disciplinary Core Ideas

Pellegrino et al. (2014), NRC

NGSS 3D Framework

Scientific and Engineering Practices:

- Asking questions
- Developing and using models
- Planning and carrying out investigations
- Analyzing and interpreting data
- Using mathematics and computational thinking
- Constructing explanations
- Engaging in argument from evidence
- Obtaining, evaluating, communicating evidence

Pellegrino et al. (2014), NRC

NGSS 3D Framework

Crosscutting Concepts:

- Patterns
- Cause and effect
- Scale, proportion, and quantity
- Systems and system models
- Energy and matter
- Structure and function
- Stability and change

Pellegrino et al. (2014), NRC

NGSS 3D Framework

Disciplinary Core Ideas:

- Earth's place in the universe
- Earth's systems
- Earth and human activity

Pellegrino et al. (2014), NRC

Next Generation Science Standards

"This integrate perspective of what it means to know science suggests that assessment should help determine where a student can be placed along a sequence of progressively more 'scientific' understanding of a given core idea that by definition includes successively more sophisticated applications of practices and cross-cutting concepts"

Pellegrino (2013), Science

PISA Framework

"The functional use of knowledge requires the application of those processes that are characteristic of science and scientific inquiry"

"test questions (items) require the use of the scientific competencies within a context. This involves the application of scientific knowledge."

- Knowledge about science
- Scientific competencies

Pisa (2009) Assessment Framework

Task Example - Tectonics

Objective: Students will recognize essential plate tectonic features and the evidence that supports the theory

Know: Know a definition of a plate boundary

Understand: The characteristics of important tectonic features and processes

Do: Use global maps of topographic, seismic, seafloor age, and volcanic features to identify and locate active plate boundaries

Appropriate Assessments

Traditional quizzes & tests
- selected response
- constructed response

Performance tasks & projects
- open-ended
- complex
- authentic