Developing and Implementing a Program-Wide Student Performance Assessment Protocol: Preliminary results

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Context of the Assessment

- JMU has an internal and external Academic Program review for each department, every seven years;
- In addition, each unit must complete an Assessment Progress Template (APT) as a part of its annual report
- The APT has been administered by the Center for Assessment and Research Studies (CARS)
- CARS administers on an annual basis General Education testing for Freshmen and those students with less than 71 SCH
- CARS has also developed generic instruments, such as the Academic Skills Inventory
- CARS also provides technical assistance in objective development and assessment construction
- Preliminary review of previous review indicated strong need for clarified goals & objectives as well as mechanism for gathering assessment data.

Goals and Objectives

- Overall Department Goals
  - developed as a function of "what we do" and "what we want to do" for our majors, for general education students, for teacher education, and for the general public
- Degree program goals are an extension of these
  - Overlap between BS and BA programs, with unique expectations for each track
- New course goals & objectives were initiated within each core course

Program Goals

- Goal 1: Educate future citizens to appreciate the complexity of complex Earth systems.
- Goal 2: Provide continuing educational outreach to the non-JMU community about the Earth, how it operates and how to think about it scientifically.
- Goal 3: Prepare highly qualified geologists and Earth system scientists
- Goal 4: Prepare highly qualified Earth science teachers
- Goal 5: Prepare students to integrate Earth systems knowledge into a broad range of careers

Degree Goals

- GOAL #1: Demonstrate comprehension of geological principles, facts, and concepts (the knowledge in the field).
- GOAL #2: Demonstrate knowledge of the variety and extent of literature in the Earth sciences (journals, books, abstracts, etc.) and be able to access and use it.
- GOAL #3: Demonstrate skillful application of methodologies of lab and field.
- GOAL #4: Demonstrate an ability to solve specific scientific problems in the Earth sciences.
- GOAL #5: Demonstrate an understanding that the geosciences are fundamentally interdisciplinary.
- GOAL #6: Demonstrate acceptance, preference for, and commitment to scientific values.
- GOAL #7: Apply knowledge of the discipline and its future trends as applied to their own continuing education and professional development.
- GOAL #8: Communicate with and advise non-scientific audiences on dynamic Earth processes that affect individuals and communities.

Development

- The assessment task that we desired was more than what we wanted students to know, but what skills and habits of mind we wished to develop
- These aspects of learning were considered to be developmental in the growth of a student, making true programs as opposed to collections of courses.
- This was reflected in program goals and objectives
- The knowledge, skills, and dispositions (KSD) were mapped to courses in matrices, with faculty indicating which course a particular item was introduced, reinforced, or applied.
- By extension, this became the expected sequence of student growth

BS Core Course Goals

Course #	GEOL 110	GEOL 230	GEOL 280	GEOL 300	GEOL 364	GEOL 365	GEOL 399
Course Name	**Phys. Geol**	**Evol. Earth**	**Mineralogy**	**Petrology**	**Stratigraphy**	**Structure**	**Field Geol.**
Earth Fractionation	I	R		S	S		
Rock Cycle Differentiation	I	R		R			
Surficial Processes	I						R
Human-Earth Interactions	S						
Deep Time							
Geologic history	I	R			R		
Biogeochemistry		I					
Tectonic evolution	I			R	R	R	R
Evolution		I					
Crystallography			I	R			
X-ray Diffraction			R				
Mineral Chemistry	I		R	R			
Physical Properties of Minerals	I		R	R			
Igneous processes	I			R		R	R
Metamorphic processes	I		I	R		R	R
Flow Regime & Facies Elements		I			R		R
Sequence Theory					R		
Depositional Systems	I				R		R
Geometric, Kinematic, Dynamic analyses				I		R	
Brittle/Ductile Fabrics						I	R
Fractal Tectonic analysis		I			R		
Field relationships		I			R	R	R

I = introduced in this course
R = reinforced/applied in this course
S = secondary focus in this course

BA Dispositions

Course #
Course Name
Habits of Mind
Draw on personal experiences with Earth Phenomena
connecting experience and learning
seeking new experiences
connecting the personal with the vicarious experience
Commit to, accept, and prefer scientific values
evaluate sources of information
accurately document observations
develop inferences supported by evidence
critically and constructively appraise conclusions
develop appropriate problem-solving strategies
recognition of seridipity
use of dialogue
value and limits of generalizations
Interdisciplinarity
Draw connections between Geoscience domains
Draw connections with other science domains
Develop and accept a systems-level appreciation
Self-Efficacy
Self-Evaluation
personal skills as a scientist
personal skills as a geoscientist
future learning needs
Growth
Commitment to professional growth
Articulation of geosciences aesthetic
Communications Confidence
Scientific audiences
Non-scientific audiences
interactive exchanges with peers
interactive exchanges with experts
E = Explicitly emphasized in course
I = Implicit component of course

BS Skills

Course #
Course Name
Science Intellectual Skills
Observation & Analysis Skills
1-D and 2-D data collection
3-D data collection
sketching
computer drafting
interpolation/extrapolation
distance/size/volume estimation
Communication Skills
collaborative work
research paper
poster presentation
web page or podcast
word processors
laboratory reports
oral presentations
metacognition
Research Skills
data collection & manipulation
spreadsheet management
statisitical analyses
lab/field data gathering/organizatior
scientific methodologies
retrieve scientific literature
independent projects
team projects

Geoscience Skills
Observation/Identification Skills
sampling techniques
observation keys
rock/mineral property ID
Fossil Identification
Analysis/Interpretation Skills
Topographic map analysis
Geologic map analysis
Rock/Mineral ID in hand/thin-section
Fossil Identification
Env/PaleoEnv. Interpretation
3-dimensional projection
graph construction
field reports
Technical Skills
Field Based
handlens
brunton compass
jacobs staff
measuring tape
GPS
GPR
GIS
Laboratory Based
Stereo microscope
Petrographic microscope
Spectrometers
map construction
sediment/soil sieving
Graphical tool use and construction
I = introduced in this course
R = reinforced/applied in this course
S = secondary focus in this course

The Task

- The overall task was one designed around a relatively complex geologic situation, including a photograph labeled with the locations of sample material, also provided
- A series of prompts, each one tied to a program goal, was provided for students to give a written response.
- The prompts were open-ended enough that student reponses were expected to become more detailed and complete by the time they had reached a late stage in their program;
- Students would be expected to complete the task at least 3 times in their stay.


Ryan, California
© 2008 Tele Atlas
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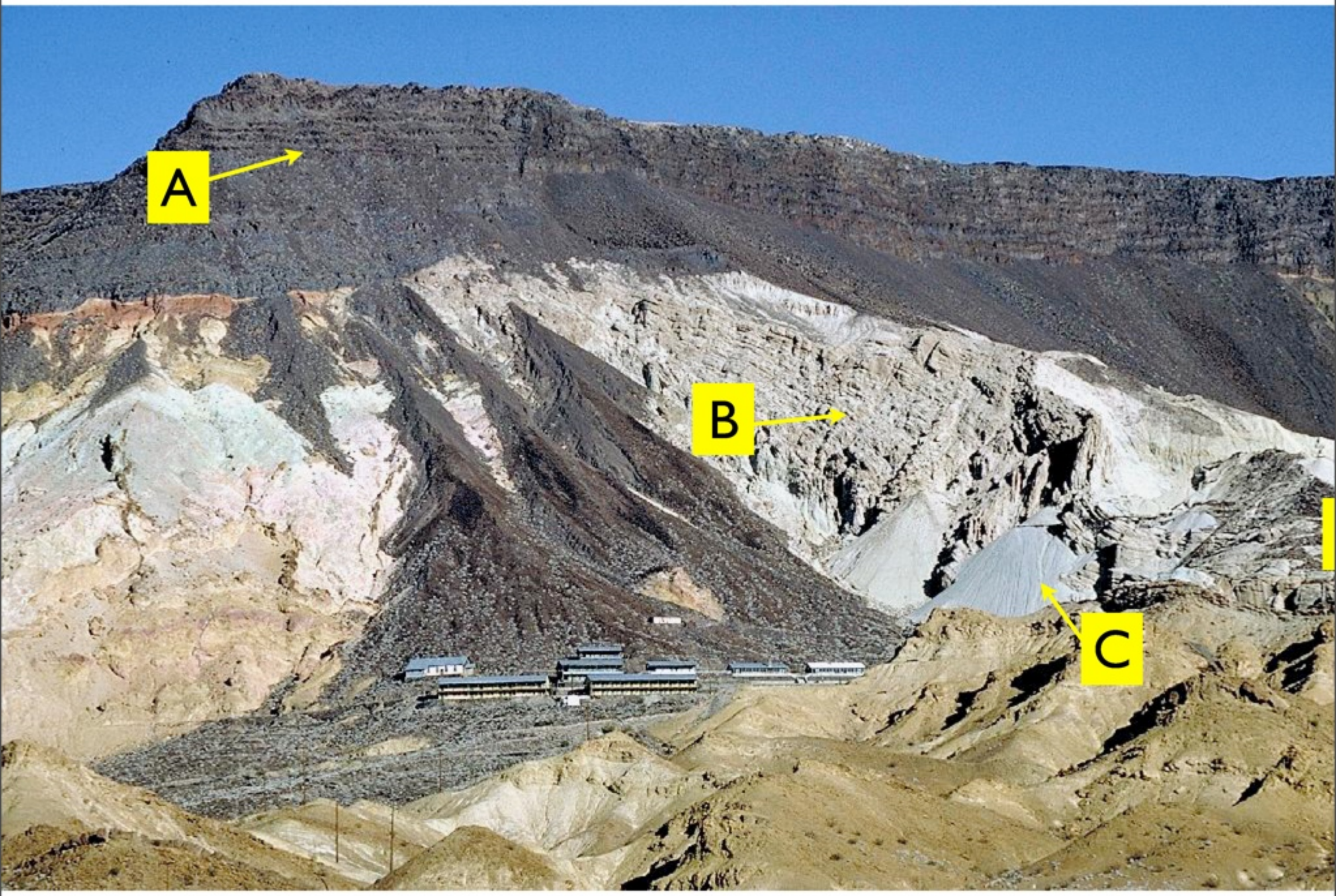
Pointer 36°19'22.29" N 116°40'10.52" W elev 983 m
Streaming 100%
Eye alt 2.26 km



Credit: Geoscience Image Bank

- For the outcrop image observed on the screen, please provide a written response to the following prompts. Please be as complete as possible. Short answers and phrases are acceptable.

  - 1. Please describe what you see, in terms of lithology, stratigraphy, and structure. Include information on color, texture, orientation, mineralogy, chemistry, etc.

  - 2. Please take note the labels on different rock layers. These correspond with the samples on the table before you. Please provide a complete description of the minerals present, the possible rock type, and other significant features, textures, and/or fossils.

  - 3. Given your description of the outcrop and the rock samples, what interpretations can you offer on (a) what environment the material was deposited or emplaced in, (b) what has happened to the material since it was first emplaced, and (c) what is likely to happen to the material in the future? How would you test your interpretations? What information would you look for?

4. Consider the responses you have provided to the first three prompts. How would you communicate your responses, using diagrams and numbers as needed, to:

   a. A relative, friend, or a teacher that was not knowledgeable in the geosciences, but wished to build or make a substantial financial investment in the immediate area;

   b. Another geoscience student that is at the same or lower class rank than yourself

   c. A geoscience professional that you might hope to work for or engage in further studies with.

5. Describe how:

   a. your preparation as a scientist has allowed you to frame your responses

   b. your preparation as a geoscientist as impacted your responses

   c. your approach to responding to the prompts has identified areas that you need further study in.

Key Rubric Elements

Lithology/Earth Materials

A. Identify the rocks present
B. Identify the minerals present in the rocks
C. Describe the texture of the rocks present
D. Identify fossils (to the order/family) present in the rocks
E. Estimate the orientation of the rocks (strike/dip)
F. Predict the chemistry of the materials

Stratigraphy & Structure

A. Bedding thickness
B. Bedding type
C. Distinguishing between primary/secondary features
D. Deformational features
E. Brittle and ductile deformation
F. Compressional and tensional characteristics

Interpretation & Inference

A. Relative Ages
B. Distinguishing between marine and terrestrial environments
C. Depositional Setting/Environment of emplacement
D. Timing of primary and secondary features
E. Identifying stress/strain relations and directions
F. Fractionation processes evident

Prediction & Retrodiction

A. Application of concepts of superposition, original horizontality, cross-cutting relations
B. Origins of materials present
C. Origins of structures observed
D. Geomorphology/Landscape evolution
E. Continued fractionation of materials.

Scientific Communication

A. Appropriate use of terminology in identifying
B. Appropriate application of terminology in explaining
C. Use of data, measurements, and visualizations to define and explain terminology
D. Pose questions to investigate concepts derived from observations of phenomena
E. Predict possible solutions to questions posed

Self-Efficacy

A. appraise personal skills as a scientist
B. appraise personal skills as a geoscientist
C. define future learning needs and expectations

Scoring

	Early Stage	Middle Stage	Late Stage
Lithology/Earth Materials	A-B	A-D	A-F
Stratigraphy & Structure	A-B	A-D	A-F
Interpretation and inference	A-B	A-D	A-F
Prediction and Retrodiction	A-B	A-C	A-E
Scientific Communication	A-B	A-C	A-E
Scientific skills and growth	A	A-B	A-C

Preliminary Results

- A rubric was keyed to capture the developmental position of student's growth
- A student who is new to the major would be expected to meet 2-4 of the criteria;
- An advanced, soon-to-graduate student would be expected to speak to all criteria.
- Administation #1 was in 2008, and for the 9 students that completed the task, lengthy responses were collected.
  - Most of these students were advanced or soon to graduate; all but one were BS-Geology students; demographic data were limited
- First administration was primarily aimed at testing the feasibility of the process; data analysis was postponed until a group of faculty could review responses and determine inter-rater reliability. This will be determined soon.

Preliminary Results

- The administration was continued in the current year, with 10 students completing the task. These students are at different points in their program, and were a mix of BA and BS students;
- More demographic data collected, to tag students to progress in degree program.
- These data are still warm, having been collected as of last Friday.
- Recent review of APT by CARS indicated that goals and objectives were greatly improved, but they needed matrices to see direct relationship of these to the task;
- The task provides a strong basis for collecting needed data (two years worth!)

Future Administration

- Assessment task seemed to work well, taking students 30-45 minutes to complete.
- The first two administrations were voluntary, tied to normal university assessment day events.
- The task will likely become mandatory, either scheduled as a part of core courses or as a part of a required professional seminar, currently in development
- The task be used in conjunction with specialized ASI and Affective instrument
- We anticipate being able to document curricular adjustments based on the collected