Assessing Student's Learning Gains in General Education Science Classes

TYLER FABIAN and JULIA ANN NORD, tfabian@gmu.edu and jnord@gmu.edu
Department of Atmospheric, Oceanic and Earth Sciences

Abstract

The Student Assessment of their Learning Gains (SALG) tool was used to enhance the George Mason University's (GMU) assessment of the Natural Science, General Education Learning outcomes. In the Fall Semester, 2013 I developed 4 questionnaires with faculty for GEOL 101 lecture and lab and GEOL 102 lecture and lab. Three areas of questions were covered in this assessment: questions preprogrammed into the SALG instrument, questions designed to cover the goals of the Natural Science Learning outcomes defined by GMU General Education committee, and finally specific questions from the syllabi of GEOL 101 and GEOL 102 that reflected the professors' learning goals. Data on student learning gains is collected in four general areas: understanding and memorization of basic concepts, skills attained, affective learning (attitudes, beliefs and positive or negative experiences) and habits or lifelong learning skills the student carries with them for their life. We also asked questions on how teaching styles, help they received in the class from faculty, TA's and peers, graded activities and feedback, and resources helped their learning. For the lab classes, we also asked specific questions about each lab. Students in GEOL 101 and 102 took the surveys after they had completed the class. From this data we will assess if the students are confident in their learning gains, are understanding and meeting the University Learning outcomes, and their attitudes about the class. Also, it will help faculty know if they are teaching to the Natural Science outcomes. Finally, these surveys can be used as formative assessment to improve the lecture and labs in GEOL classes.

SALG Theory of Learning

UNDERSTANDING:
Key words: Knowing, memorizing, insight, seeing the logic.
- Mineral identification and importance.
- Describe the Earth's geologic features.
- "Has really opened my eyes to recognize the processes that the earth undertake to come to the present state its in now."

SKILLS:
Key terms: Identify, Recognize, Understand, Patterns in data
- Scientific inquiry based on evidence from the natural world
- Scientific knowledge changes based on new evidence
- "I have gained the skills of recording data in a different way and being able to process that data into results."

AFFECTIVE:
Key terms: Enthusiasm, Gaining confidence, Willingness
- Gain confidence in the subject area
- Attitude toward Geology
- "It made me realize that Geology isn't a boring science because the Earth, as well as everything else, is evolving."

INTEGRATION:
Key terms: Applying, Connecting, Reasoning
- Relationship between the natural sciences and society
- Systematic reasoning to a problem
- "My sense of wonder about the world first and foremost, and viewing things in a scientific manner--that is to say, asking questions and researching the answers that I want to know more about."

Mason Core Requirements for Learning Outcomes

1. Understand how scientific inquiry is based on investigation of evidence from the natural world, and that scientific knowledge and understanding:
- **evolves based on new evidence**
- **differs from personal and cultural beliefs**
2. **Recognize the scope and limits of science.**
3. **Recognize and articulate the relationship between the natural sciences and society and the application of science to societal challenges (e.g., health, conservation, sustainability, energy, natural disasters, etc.).**
4. Evaluate scientific information (e.g., distinguish primary and secondary sources, assess credibility and validity of information).
5. **Participate in scientific inquiry and communicate the elements of the process, including**:
- Making careful and systematic observations
- Developing and testing a hypothesis
- Analyzing evidence
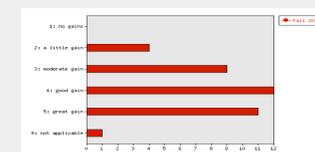- Interpreting results

Methods

Fall 2013. Survey questions were developed with four faculty members teaching introductory courses.
December 2013 and January 2014, students were asked to complete the questionnaire online. Sample size for GEOL 101 was 36 students.
Spring 2014 Analysis of results.
- Likert scale. 1-5 with 1 having no gains and 5 having great gains.
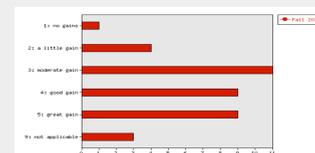- Open ended questions

Results for Mason Core Outcomes

As a result of your work in this class, what GAINS DID YOU MAKE in your UNDERSTANDING of each of the following?
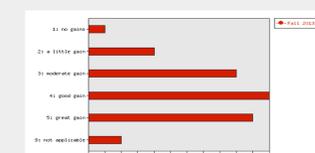

1. How science evolves based on new evidence?
N: 36
Std dev: 1.00
Mode: "4: good gain"
Number of answers at the mode: 12

2. How science differs from personal and cultural beliefs
N: 34
Std dev: 1.10
Mode: "3: moderate gain"
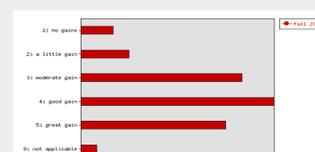Number of answers at the mode: 11

3. That science has limits
N: 35
Std dev: 1.10
Mode: "4: good gain"
Number of answers at the mode: 11

4. Scientific inquiry is based on evidence from the natural world
N: 36
Std dev: 1.13
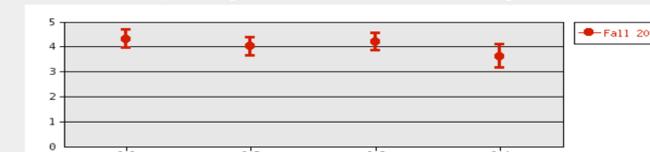Mode: "4: good gain"
Number of answers at the mode: 12

5. The relationship between the natural sciences and society.
N: 36
Std dev: 0.94
Mode: "4: good gain"
Number of answers at the mode: 15

Results GEOL 101 Outcomes

HOW MUCH did each of the following aspects of the Class HELP YOUR LEARNING? 1:no help 2:a little help 3:moderate help 4:much help 5:great help
6.1 Attending lectures
6.2 Powerpoints
6.3 Availability of powerpoints
6.4 Participating in discussions during class

Conclusions

Students in GEOL 101 do show confidence in their learning gains
Evidence shows that they are meeting the Mason Core Learning Outcomes

Future Plans

I plan to continue to find ways to help student learning improve through these types of questions and have students not only evaluate the teacher or class, but ultimately their learning experience and how they find the best way to learn in specific subjects. I will be able to manipulate this tool for other requirements with Mason's Learning Outcomes.

REFERENCES/Acknowledgements

SALG Program and Website

From assistance with Emily Nord in statistics

NOYCE Program Mason Scholars

Mason Geology Department