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OLD DOMINION UNIVERSITY  
SCIENTIFIC REASONING COMPETENCY

**Definition of Competency:**

The [mission](#) and goals of Old Dominion University require that **“every Old Dominion undergraduate student follow a general education program that is designed to develop the intellectual skills of critical thinking and problem solving and to encompass the breadth of understanding needed for personal growth and achievement and for responsible citizenship.”**

In addition, Objective 1.3 of the [Old Dominion University Strategic Plan: 2000-05](#), states that the University will “continue to offer a high-quality general education curriculum to all undergraduate degree-seeking students and assess the general education program for quality and effectiveness . . . by monitoring the general education requirements implemented in 1998 to review their effectiveness.”

The goals of Old Dominion University’s [General Education program](#) include the establishment of competency in the natural sciences. In a two-course natural science sequence (including laboratory), students **“are introduced to the disciplines and methods of science and develop the abilities to make reasoned judgments based on scientific and technological considerations.”** Natural science courses are defined as Biology, Chemistry, Geology, Oceanography, and Physics. In addition to the above courses, students are required to take a third course in a second natural science or technology area.

The goals of measuring Scientific Reasoning Competency are to determine how well our general education requirements prepare students and to make appropriate curricular revisions, if necessary, to improve student performance.

**Standards for Competency:**

*Scientific reasoning is characterized by adherence to a self-correcting system of inquiry that relies on empirical evidence and testable theory to describe, understand, predict and control natural phenomena.* Specific competencies include the ability to:

1. Draw conclusions based on valid evidence or proof;
2. Use the process of scientific reasoning;
3. Use scientific results to reach appropriate conclusions.

### **Description of Methodology Used to Gather Evidence of Competency:**

Due to budget constraints, the **method of assessing scientific reasoning competency was revised in 2003-04 and a pilot study was conducted during the spring semester 2004.** The new methodology involves embedding the measure(s) in the five natural science courses designed to meet students' general education requirements. Faculty within each discipline responsible for the courses will design a test of the three competencies to be administered as part of the final exam in the course. Each test will be a 9-12 item multiple-choice examination with 3-4 items measuring each competency. All items will be 4 - 5 choice, multiple-choice questions with no "none of the above" or "all of the above" type distracters. Students who correctly answer 60% of the items and pass the course will be considered competent in scientific reasoning. Those who do not pass the course will be assumed to be less than competent in scientific reasoning and thus will not be counted as part of the sample. They will be counted in a future sample when they successfully complete the course. The Office of Institutional Research and Assessment will independently score the examination(s).

**Summary:** (75 words) (Provide brief analysis of results)

	<b>Chemistry 115N</b>	<b>Oceanography 107N</b>	<b>Total</b>
N, % competent	368 / 86%	140 / 51%	508 / 72%
N, % less than competent	59 / 14%	135 / 49%	194 / 28%

The two courses chosen for the pilot study included a Chemistry course required for science and engineering majors and a general education Oceanography course designed for non-science majors. Overall, 72% of the students in the sample who passed the course earned a passing score on the scientific reasoning portion of the exam. Eighty-six percent of the students in the Chemistry course demonstrated scientific reasoning competency as compared to fifty-one percent of the non-science majors. These results suggest that science courses for non-science majors need an increased emphasis on scientific reasoning. Faculty will begin discussions this summer on curricular changes that can be made in general education science courses to improve student understanding of scientific reasoning.