Assessment Plan Reporting Template (APRT)
Old Dominion University
Dr. J. Worth Pickering, Assistant Vice President for Institutional Research and Assessment
Scientific Reasoning (2009-10)

PART A

1.0 Definition of Terms

1.1: ***Identify the core area to be assessed.*** Scientific Reasoning is characterized by (1) students gaining a body of scientific knowledge about how the world around them works, and (2) subsequent application of that scientific knowledge to specific situations

As stated in the *Old Dominion University (ODU) Undergraduate Catalog for 2008-2009*, "the general education program at Old Dominion University represents the common core of the baccalaureate degree. It prepares students for pursuing a major, for broadening their views of life, and for understanding an increasingly global and diverse world. It provides students with the basic skills and intellectual perspectives to engage in the search for knowledge. The general education program develops analytical and critical thinking skills and the ability to make reasoned judgments. Students will also discover that learning is a complex, multifaceted, and lifelong endeavor" (p. 63). All six of the SCHEV competencies are part of the general education program at ODU. The third goal, "develop an understanding of the natural sciences and technology and their contributions to human culture," focuses on scientific reasoning through two objectives: (a) "understand the concepts and methods of the natural sciences" and (b) "understand the nature of technology and/or the impacts on society"

1.2: ***Identify the criterion or criteria that indicate competency in the core area***. Students who attain the scientific reasoning competency at Old Dominion University will score higher on the scientific reasoning post-test exam than the pretest exam.

1.3: ***Describe the learning objectives for the defined core area***. Students will be able to…
1. Explain the basic terms and concepts of a scientific discipline; and
2. Apply these terms and concepts appropriately to understand the world around them.

2.0 Methodology

2.1 ***Describe the value added analytic approach being used, with reference to the Guidelines***. A pretest exam will be administered to all students enrolled in one of the eight natural science courses designed to meet general education requirements (Physics, Oceanography, Biology, and Chemistry) at the beginning of each course. The questions will be locally developed or adopted from professional organizations by groups of faculty within each discipline who are responsible for developing and teaching the courses. The exams will test students' acquisition of basic terms and concepts of a discipline and their ability to apply that knowledge to understand the world around them. Students will be tested again on these same

concepts at the end of each course. A longitudinal approach will be used to measure the value added to students' scientific reasoning learning outcomes.

2.2 ***Explain how educational experiences at the institution produce student learning and reasons for choosing the analytical approach in 2.1***. Much initial learning in the sciences is focused on the acquisition of basic terms and concepts within the field. As this knowledge base grows during the semester, faculty members provide learning opportunities in lecture and lab situations that enhance students' abilities to apply knowledge gained in real world situations. Hence, a course embedded, pretest/posttest design will be used to document learning in this setting.

2.3 ***Elaborate upon the expected reliability and validity of the analytical approach mentioned in 2.1.*** Content validity is assured by asking faculty within each discipline responsible for one of the eight science courses to design both the course and the exam to address the two outcomes. The exam will measure students' acquisition of basic terms and concepts of a discipline and their ability to apply that knowledge to understand the world around them. The Undergraduate Curriculum Committee in the department will be asked to assess the exam for content validity. Internal consistency (reliability) of the exam will be calculated using Cronbach's alpha.

2.4 ***Explain generally the student population from which samples, cohorts, or groups will be drawn***. The cohort will consist of all students (first year, transfer, and continuing) enrolled in one of the eight natural science general education courses during the 2009 fall semester. Based on the 2007 fall semester, we can estimate enrollment for the 2009 fall semester to be about 1,400.

2.5 ***Explain the technique used for data collection with reference to the Guidelines.*** A course-embedded method will be utilized for collecting data. Both the pretest and the posttest exams will be administered and the data will be collected within a classroom setting.

2.6 ***Describe and explain measurement strategies to be applied during the pre assessment with reference to the Guidelines***. A required pretest will be administered very early in the semester to provide a baseline for students' scientific reasoning knowledge and skills.

2.7 ***Describe and explain measurement strategies to be applied during the post assessment with reference to the Guidelines***. A posttest will be administered at the end of the semester, which provides the basis for measuring value added in students' scientific reasoning knowledge and skills.

2.8 ***Explain the nature of value added given 2.6 and 2.7.*** Normalized gain scores will be calculated for the pretest and posttest scores of all students who pass the course. Students who do not pass the course will not have fulfilled their general education requirement and therefore will not be included in the final analysis. They must repeat the class at which time they will be tested again. Normalized

gain is defined as how much the student learned from the course (the raw gain) divided by the maximum amount she or he could have learned (as measured by the test). Normalized gain is calculated by:

g = (post test score minus pretest score) / (100% minus pretest score).

3.0 Process evaluation

3.1 ***Describe and explain how the results will be reported to institutional units, students, and external constituents***. Scientific reasoning assessment results will be released through the same channels all assessment results are released at Old Dominion University: via the Provost's Council, meetings and presentations at the College and department levels, and through written reports of results. In addition, the University assessment team will meet with the science faculty and assistant/associate deans to evaluate assessment results and the methodology to ensure that a reliable and valid value added assessment process is in place.

3.2 ***Describe how the results have been and will be used to improve educational experiences and advance the mission of the college or university***. The assessment of scientific reasoning is only one part of the assessment plan for the College of Sciences. All academic programs are engaged in continuous quality improvement and we track their plans for improving student learning among their majors through WEAVEonline. Most disciplines are also implementing and assessing a variety of programs to improve student learning and student success, especially among first year students. **Physics** is experimenting with using clickers to administer quizzes, created a Physics Learning Center, implemented scale-up in 2008-09, and implemented a math boot camp in late summer 2008. **Oceanography** participated in the math boot camp in summer 2008 and is assessing its use of clickers to administer pop quizzes in lecture and enhance scientific reasoning in a large lecture (300 students) format. **Chemistry** uses clickers for in-class quizzes and monitoring of attendance. Chemistry also holds a weekly, 1-hour recitation session, and in conjunction with Education, created a series of videos in which chemistry undergraduate students demonstrate how to solve common general chemistry problems for distribution on ODU's YouTube site. **Biology** recently completed a thorough revision of its introductory Biology sequence for majors and its two-semester non-majors offerings to include increased emphasis on scientific reasoning. These revisions include use of regular Blackboard quizzes for review and the implementation of new exercises and assessment methods in both lecture and laboratory. All of these programs have assessment plans. The assessment of scientific reasoning informed the revision of the general education curriculum during 2007-09 so they are in alignment. Based on the results of this assessment faculty members in each discipline will have the opportunity to reflect on the impact of each course on students' scientific reasoning abilities and to identify needed course-based changes to help students to meet the desired learning outcomes.

3.3 ***Estimate the costs of the proposed assessment. Provide a narrative of the calculation as well as pertinent statistics***. If funding is available, faculty teaching the courses will participate in a workshop designed to help them write reliable and

valid test items for the exams (approximately $3000). In addition, Institutional Research and Assessment offered faculty an honorarium of $1500 each to develop the exams during the summer 2008 (approximately $12,000). Total anticipated direct costs are approximately $15,000. The indirect costs of the time committee members and Institutional Research and Assessment staff have spent and will spend on the assessment are estimated based on a SCHEV formula using median salaries. The indirect cost for faculty is .3 of the median associate professor in the College of Sciences plus benefits which is $26,078. Similarly, the median cost for administrative time is .30 of the median administrative faculty in assessment which is $32,174. The total estimated indirect costs are $58,252 and the total estimated direct plus indirect costs are $73,252.

PART B

4.0 Data Presentation (leave blank until data is due)

4.1 Explain any challenges to data collection, and how they were addressed..

4.2 Describe the value-added (or competency) information/data that was collected. This information should include, but is not limited to, quantitative or qualitative summaries of the differences between pre and post assessments or any performance data

4.3 Describe any additional evidence of value added (or competency); this might include faculty testimony, student retention, or post graduation evidence.