Coverage and assessment of Learning Goals in General Education Science and Technology Courses

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Executive Summary

A graduate student from the University of Connecticut's Neag School of Education was hired to interview instructors of General Education Science and Technology Content Area 3 (CA3) courses to determine how and where they addressed the CA3 learning goals, listed in UConn's General Education Guidelines, in their courses and the extent to which they assessed whether students achieved these objectives.

Professors from Biology, Cognitive Science, Ecology and Evolutionary Biology, Marine Sciences, Nutrition, Psychology and Physics, who taught courses taken largely by non-science majors, agreed to participate in the evaluation. Individual meetings were set up between the GA and the professors. The first meeting focused on whether and how the professors met the CA3 learning goals through their instruction. Available instructional materials and course websites were shared. At the second meeting, the discussion centered on how professors assessed whether students met the CA3 learning objectives in their courses. Assessment materials were collected and evaluated. At these meetings, each professor was asked to rate how well they addressed each CA3 objective in their instruction and how well they assessed student competencies. The GA independently rated assessment in each course, based on her reading of the materials supplied by the instructors. A 4 point rating scale was used and courses were judged to be meeting an objective if they scored a 3 or 4.

Half of the courses covered all of the learning goals and the other half omitted only 1 or 2 of them. Learning Goals 1(content and vocabulary), 4 (science vs. pseudoscience) and 7 (scientific impact on the world) were well covered in all courses. Learning Goal 8 (scientific inquiry skills) was instructed in all courses that had a lab component. Other goals were covered in 9/10 courses, with the exception of Learning Goal 3 (scientific method), which was instructed in 5/10. Since the GA did not directly observe instruction, these data represent the professors' own ratings, but overall coverage of the learning goals appears good.

Assessment within courses of whether students achieved these learning objectives was less complete. Two courses assessed learning in all goal areas and 4 assessed all but 1. Three assessed learning in 5/7 goal areas and one included only 4/7. All courses evaluated Learning Goal 1(content and vocabulary) and all lab courses Learning Goal 8 (scientific inquiry skills). Learning Goal 2 (methods and technologies), 4 (science vs. pseudoscience), and 6 (unresolved scientific questions) were assessed in most courses. Learning Goal 7 (scientific impact on the world) was assessed in 7/10 courses and 5 (scientific experiment description) in 6/10 courses. Learning Goal 3 (scientific method), was assessed in 4/10 courses. Some differences were noted between the professors' self-ratings and those of the GA, though these appeared minor.

Overall, CA3 courses are addressing almost all of the Learning Goals established for this content area. Assessment of student achievement of the learning objectives is less complete. A number of exemplary practices, both with respect to instruction and assessment were identified. A meeting was held with the participating instructors where the preliminary findings of the assessment were shared and they were asked to talk about the exemplary practices that had been identified. A rich and powerful conversation resulted that could usefully be sustained. In addition, direct assessment data need to be collected on student learning in CA3 learning goal areas, using assessment items already located within these courses as well as those newly developed.

Introduction

The University of Connecticut instituted a new set of General Education Requirements in 2005 and the General Education Oversight Committee (GEOC) is now evaluating the extent to which the program is meeting its goals. As a first step in those efforts, in consultation with faculty teaching the relevant courses, GEOC is translating the original criteria for inclusion of courses in each content area into a set of learning goals and objectives to be met by students. This process was completed for the Science and Technology Content Area (CA3) and the new learning goals are given in Appendix 1. These goals were articulated in this form after the approval of courses for inclusion in the content area. Thus although the learning goals were derived from the criteria for inclusion, it was important to determine how well CA3 courses could be mapped onto these goals. The current assessment was designed to determine the extent to which CA3 instructors covered the CA3 Learning Goals in their courses and then also the extent to which they assessed whether student learning in these areas had actually occurred. This is the first GenEd content area to be evaluated in this way and the hope is that this will provide a model for the examination of the other content areas.

Methods

Courses were selected that covered a wide range of biological, physical, and cognitive sciences. Both laboratory and non-laboratory courses were included and larger courses were favored because they impact more students. Courses intended as gateways to science majors were excluded since the intent here was to consider courses that might provide the only opportunities for students to learn science at UConn. Courses needed to be taught in the current spring semester. Fifteen such courses were identified and ultimately nine were selected, four of which were designated as meeting the laboratory requirement. Since one (PHYS 103/104) was offered in both non-lab and lab formats, a total of ten courses were evaluated. These are listed in Table 1 and included 4 biological, 3 physical and 2 cognitive sciences courses. Participation within this study was completely voluntary and the openness of instructors to participate was noteworthy.

Table 1 Courses included in this evaluation

Course		Enrollment	Lab/non-Lab
Biological Sciences			
BIOL 102	Foundations of Biology	200	Lab
BIOL 103	The Biology of Human Health and Disease	70	Lab
EEB 202	Evolution and Human Diversity	74	Non-Lab
NUSC 165	Fundamentals of Nutrition	110	Non-Lab
Physical Sciences			
MARN 170	Introduction to Oceanography	51	Non-Lab
PHYS 103/104*	Physics of the Environment/with Laboratory	32	Non-Lab/Lab
PHYS 155	Introductory Astronomy with Laboratory	68	Lab
Cognitive Sciences			
COGS 201	Foundations of Cognitive Science	50	Non-Lab
PSYC 132	General Psychology I	308	Non-Lab

*This course was evaluated in both non-lab and lab formats, giving a total of 6 non-lab and 4 lab courses.

The study was divided into three parts. First, instructors were interviewed to determine the extent to which they addressed the CA3 learning goals through instruction within their course. A second interview focused on whether and how professors assessed these CA3 learning goals. The third part involved sharing the results of these interviews with the group and a discussion that highlighted good instructional and assessment practices.

In Part I, an interview was arranged between the GA and each professor to establish a connection and allow an open-ended discussion of which learning objectives were addressed and in what ways within the course. The learning goals for CA3, as approved by GEOC and derived from the criteria listed in the GEOC Guidelines are detailed in Appendix 1. The GA asked questions such as, “Do you address Learning Goal 1, content and vocabulary, within your course? If yes, in what topics and how?” The interview responses were transcribed by hand. The

professors were also asked to share copies of any written materials, access to their course website, and their syllabi. The GA then reviewed these materials for additional evidence that the Learning Goals were being addressed. At the end of the interview, each professor was asked to complete a Self-Rating Scale (Appendix 2a), in which they evaluated how well they addressed each learning objective. The scale ranged from 1 to 4, with 1 being "not at all addressed" and 4 being "addressed thoroughly." Since the GA did not attend any classes and had only partial access to course materials, the scores given for how well each learning goal were addressed are those of the professor. However, the individual narratives for each course (Appendix 3) include some descriptions of the extent to which instructors own scores were corroborated by other material.

Part II comprised a separate interview with each professor to understand how the learning goals were assessed within each course. Professors were asked questions such as, "What are your primary assessment methods? Can you think of specific questions or topics you might use to assess Learning Goal 2?" The interview responses were transcribed by hand. Also during this interview, the professors were asked to share any assessment materials they use in their course. Each assessment method was reviewed and coded by the GA, using the learning goals as a coding set. The professors were also asked to complete a Self-Rating Scale (Appendix 2b) in which they evaluated how well they assessed each learning goal. The scale ranged from 1 to 4, with 1 being "not at all assessed" and 4 being "assessed thoroughly." The results from this scale were then compared to the results found by the GA from a review of the written assessment materials. The narrative findings for individual courses from Part II can be found in Appendix 3.

After the data from the individual interviews were collated, instructors were invited to a meeting to discuss the findings. All but one participant were able to attend, Representatives from GEOC and the Institute for Teaching and Learning were also in attendance.

Findings

General Results

Each course was rated on a scale of one to four (with four being the highest level) with respect to both instruction and assessment. For instruction these scores were based on the professor's self-rating. These ratings were made at the end of the first interview, following

extended discussion on instruction aimed at the learning goals and so have some credibility. The course materials collected also provided further support for these assessments, though no direct observations of instruction were made. For evaluation of assessment, more written materials were available and so the GA was able to make an independent judgment of the extent to which student achievement of goals was assessed.

Courses needed to be scored at a 3 or a 4 to be considered as addressing and/or assessing a learning goal. It was found that in terms of instruction, all courses scored a 3 or above in most areas (Table 2). For the 6 non-lab courses, 3 addressed all areas and 3 covered 5 out of 7. The 4 lab courses covered 7 or 8 of the 8 learning goals. Thus courses provided good to excellent coverage of the CA3 learning goals as a whole. Learning Goals 1, content and vocabulary, 4, science vs. pseudoscience, and 7, scientific impact on the world, were addressed in all courses.

Table 2. Extent to which CA3 goals are taught in GenEd science courses

Learning Goal	BIOL 102	BIOL 103	COGS 201	EEB 202	MARN 170	NUSC 165	PHYS 103	PHYS 104	PHYS 155L	PSYC 132
1. Basic Concepts and Vocabulary	4	4	4	4	4	4	3	3	4	3
2. Methods and Technologies	4	4	4	3	4	2	3	3	4	3
3. Scientific Method	2	3	4	3	3	2	2	2	3	2
4. Science vs. Pseudoscience	3	3	3	4	3	4	3	3	3	4
5. Scientific Experiment Description	4	3	3	4	3	3	1	3	3	3
6. Unresolved Scientific Questions	3	4	4	4	4	4	3	3	4	2
7. Scientific Impact on the World	3	4	3	3	4	3	3	3	3/4	3
FOR LAB COURSES										
8. Scientific Inquiry Skills	4	4	n/a	n/a	n/a	n/a	n/a	3	4	n/a

Key: 1=Not at all; 2=Barely; 3=Sometimes; 4=Thoroughly. To be considered as successfully meeting Learning Goals, courses must have a score of 3 or 4.

Learning Goal 8, scientific inquiry skills, was instructed in 4/4 laboratory courses, the only ones expected to meet that goal. Learning Goals 2, methods and technologies, 5, scientific method description, and 6, unresolved scientific questions, were instructed in 9/10 courses. However, Learning Goal 5, the scientific method, was only covered adequately in half of the courses evaluated.

This evaluation of instruction is really a curriculum mapping exercise. It was designed to determine how well the goals of the individual courses are aligned with those of the content area. This alignment appears to be excellent with the exception of Learning Goal 3, the scientific method, suggesting that instructors should either place more emphasis on this goal or GEOC should reconsider its necessity within this content area.

Instruction does not always result in learning and so coverage of these goals does not necessarily mean that students will attain the learning outcomes associated with these goals. Assessment of student learning in these areas is also required and this was the subject of the second interview. In general, learning goals were assessed less completely than they were taught, with only 2 courses attempting to assess learning in all goal areas (Table 3). Lab courses appeared to do better, omitting at most one learning goal. Three of the non-lab courses assessed learning in only 5/7 goal areas and one only included 4/7. All courses made assessments relevant to Learning Goal 1, concepts and vocabulary, and all lab courses Learning Goal 8, scientific inquiry skills. Almost all courses made assessments of Learning Goal 2, methods and technologies, 4, science vs. pseudoscience, and 6, unresolved scientific questions. Learning Goal 7, scientific impact on the world, was assessed in 7/10 courses and Learning Goal 5, scientific experiment description, in 6/10 courses. Learning Goal 3, scientific method, was thought by instructors to be assessed in 8/10 courses, which is surprising since only 5/10 claimed to teach it. However, direct evidence for assessment of this goal was found in only 4/10 courses. Again, the scientific method would appear to be the learning goal that requires reevaluation, within courses and the content area.

GA ratings of the extent to which learning in goal areas was assessed differed somewhat from instructor self-ratings. However, in almost all cases there was only a 1 point difference on the 4 point scale. There were 20 instances of GA rankings being lower than instructors and 15 of them being higher. Particularly since the GA did not have access to all assessment instruments,

it appears that in general instructors do not exaggerate the extent to which they assess CA3 outcomes in their courses.

Table 3. Extent to which CA3 Learning Goals are assessed in science GenEd courses

Learning Goal	BIOL 102		BIOL 103		COGS 201	EEB 202		MARN 170		NUSC 165		PHYS 103		PHYS 104		PHYS 155L		PSYC 132	
1. Basic Concepts and Vocabulary	4		4		4	4		4		4		3	4	3	4	3	4	4	
2. Methods and Technologies	4		4		4	3		4		2	3	2	3	2	3	4		3	
3. Scientific Method	4	2	3	2	3	4	3	1		2	1	4	2	4	3	3	1	3	4
4. Science vs. Pseudoscience	3		3		3	4	3	2		3		4	3	4	3	4	3	4	2/3
5. Scientific Experiment Description	4	3	3	2/3	3	3		1	2	2		1	2	4	3	4	3	3	3/4
6. Unresolved Scientific Questions	4	3	4	3	4	3		3		3		3		3		3/4	2/3	3	1/2
7. Scientific Impact on the World	4		4		2	3	4	4		2		3	4	3	4	3	3/4	2	2/3
FOR LAB COURSES																			
8. Scientific Inquiry Skills	4		4		n/a	n/a		n/a		4*		n/a		4		4		3	4*

Key: 1=Not at all; 2=Barely; 3=Sometimes; 4=Thoroughly. To be considered as successfully assessing Learning Goals, courses must have a score of 3 or 4. Both instructors and the GA separately rated assessment of Learning Goals. A single number for a course indicates agreement. Where two numbers are given, left =instructor, right = GA score.
*These courses assessed goal 8 even though they are not CA3 lab courses.

Exceptional Instructional Methods

Within this study, several instances of exceptional instructional practices were identified that help students learn and achieve the learning goals have been discovered. These approaches were highlighted at the group meeting of instructors and will be briefly outlined here.

Dr. Fry, instructor for BIOL 102, does a form of pre-assessment in which he asks students to fill out note cards that describe what they already know and what they'd like to learn. This is a very empowering activity for both professor and student. He also implements elements of the Learning Cycle, an instructional technique that encourages student exploration and internalization of one scientific concept at a time. The stages of this cycle are: Engage, Explore, Explain, Elaborate, and Evaluate. Although it does take more time to implement than a regular lecture, it likely results in deeper learning. Dr. Fry also provides well organized lecture outlines at the beginning of class that helps students follow along as well as acting as a study guide.

To spark interest within Dr. Peterson's PHYS 155 course, she often projects current pictures taken of planets or space and uses them to promote discussion or understanding of a topic.

Dr. Smolin, professor of BIOL 103, also increases interest in students by applying biology concepts to everyday life in her lectures. She does this through current examples of relevant disease and technologies. She also fosters inquiry skills quite well through the lab component. Although the labs are closed-inquiry, meaning students are provided with the problem and procedures, students are still asked questions that require them to construct an answer based on their data.

Learning Goal 3, the scientific method is often not covered well. Many professors said that students should be arriving with this information and/or this is not the way most modern science occurs. Scientific discoveries can be serendipitous. Dr. Tabor and Dr. Bontly, instructors for COGS 201, do cover Learning Goal 3 quite well. These professors, after instructing students on the characteristics of a good scientific model or experiment, ask them to write their own model/experiment and to analyze whether or not their hypotheses are falsifiable.

Dr. Schlichting (EEB 202) also instructs students quite well in the scientific method. He does this through reading assignments as well as by presenting students with two data sets along with a hypothesis and asking students to analyze the data, and make deductions from them. Dr. Schlichting also uses games to help students internalize concepts. For example, he uses the familiar childhood game of 'Telephone' to demonstrate genetic mutation. This instructional approach also engenders interest among students.

Dr. Skoog, MARN 170, uses in-class exercises that highlight the application of a recently learned concept. Although this could also be used as an assessment technique, Dr. Skoog uses

these exercises to promote understanding and application of oceanographic techniques, theories, and also to informally monitor student understanding of concepts.

Exceptional Assessment Methods

Excellent instructional methods employed by the professors of this study were more evident than exceptional assessment methods. However, some useful approaches to assessment were discovered including the form of the exam, take-home activities, lab exercises and, in one or two instances, specific questions that could be transferred across the disciplines.

The most interesting form of assessment that was discovered was in Dr. Skoog's, MARN 170. She uses a pyramid approach in which there are two identical exams. Students are required to take the first exam alone within a fixed time frame. Then, they take the second exam, but now they can consult their peers, notes, and textbook. Scores on both exams are combined for a final score. Dr. Skoog feels this is a very effective way to assess students and to deepen learning because of the interactive reasoning involved.

Next steps

Overall, this evaluation demonstrated that introductory science courses at UConn are exposing students to the concepts and knowledge expected of those approved for CA3. All courses covered most learning goals and some courses included all of them. The learning goal that was less well covered than others was the scientific method, which was often assumed rather than explicitly taught. GEOC and its CA3 subcommittee should consider whether courses should be asked to put greater emphasis in this topic. In addition, direct assessment methods could be used to see whether students do understand the scientific method, regardless of whether it is taught in these specific classes.

Most courses also did a reasonable job of assessing whether or not students had met the CA3 learning objectives. However assessment of learning was less complete than coverage by instruction. Again, Learning Goal 3 was assessed by fewer courses than any of the other goals, though Goals 5, scientific experiment description, and 7, scientific impact on the world, were not assessed well in 3 or 4 courses. Instructors can be encouraged to include these goals in their

assessment strategies, in part by sharing with them details of how student learning on these areas is assessed in other courses.

One joint meeting was held for faculty who participated in this project and a rich discussion occurred. Additional, more focused discussions would be beneficial, for example addressing teaching and assessment of particular learning goals. Discussions with the Institute for Teaching and Learning could result in a series of workshops for science faculty, as well as graduate students, on successful approaches to, as well as the challenges of teaching GenEd science courses.

At this point, there is no information on student performance on the various assessment instruments that were identified. This is probably the most important next step. Evaluation of the assessment instruments used show that while some learning goals, in particular basic concepts and vocabulary, tend to be heavily emphasized, others are not. Thus, overall course grades cannot be used to determine whether GEOC Science and Technology learning goals have been met. It would be useful to design a set of examination questions that assessed CA3 learning outcomes, which could be customized to each course and then included in their own testing processes. Separate scores for these items would reveal the extent to which students are meeting these objectives. A few test questions immediately applicable across courses were identified, but for the most part producing such an instrument will require generalizing existing questions from these courses or constructing new ones.

Although not explicit in the Science and Technology learning goals, increasing interest in science and developing more positive attitudes towards the field are reasonable outcomes to expect from CA3 courses that are also consistent with the overall goals of GenEd at UConn. To determine whether CA courses achieve this outcome, a science self-efficacy tool was developed (Appendix 4). This tool has not been shared widely or used at all at this point. It should be reviewed by GEOC and its committees as well as by CA3 faculty and following any modifications incorporated into courses. It would probably be most effective if used at the beginning and the end of semester in order to measure attitudinal changes occurring during the teaching of the course.

Appendix 1

Learning objectives for General Education Science and Technology Courses, CA3

Definition and Criteria of CA3 (from GEOC guidelines):

These courses acquaint students with scientific thought, observation, experimentation, and formal hypothesis testing, and enable students to consider the impact that developments in science and technology have on the nature and quality of life. Knowledge of the basic vocabulary of science and technology is a prerequisite for informed assessments of the physical universe and of technological developments.

Courses appropriate to this category should:

1. Explore an area of science or technology by introducing students to a broad, coherent body of knowledge and contemporary scientific or technical methods;
2. Promote an understanding of the nature of modern scientific inquiry, the process of investigation, and the interplay of data, hypotheses, and principles in the development and application of scientific knowledge;
3. Introduce students to unresolved questions in some area of science or technology and discuss how progress might be made in answering these questions; and
4. Promote interest, competence, and commitment to continued learning about contemporary science and technology and their impact upon the world and human society.

Laboratory courses in this category must teach fundamental principles of the biological and/or physical sciences through hands-on participation.

Mission:

- To acquaint students with scientific thought, observation, experimentation and formal hypothesis testing
- To introduce students to the basic vocabulary of science and technology and the process of scientific inquiry so they can make informed assessments of the physical universe and of technological developments.
- To enable students to consider the impact that developments in science and technology have on the world, its processes, and the quality of life

Learning Goals:

Students should:
1. know the basic concepts and vocabulary of two areas of science or technology and the importance of these areas to modern society

2. be familiar with at least two contemporary scientific or technical methods and understand how they are applied to gain scientific or technical knowledge

3. be able to explain the conceptual basis of the Scientific Method , including its definition, motivation, steps of application, hypothesis testing, and misapplications

4. be able to distinguish between science and pseudoscience

5. be able to describe a scientific experiment that he or she is familiar with and explain how it applies the steps of the scientific method

6. be familiar with some unresolved scientific questions

7. be able to analyze debates about the roles science and technology play in shaping the world and human society

8. acquire skills associated with scientific inquiry

Learning Objectives

Students must be able to:
1a. describe the underlying principles of two areas of science or technology.
1b. explain why these areas of science and technology are important to modern society

2. describe at least two contemporary scientific or technical methods and how these methods are used to advance knowledge

3. explain the conceptual basis of the Scientific Method , including its definition, motivation, steps of application, hypothesis testing, and misapplications

4. analyze hypothetical or real scenarios to discern integrity of scientific claims

5. describe a scientific experiment or test and explain how it applies the steps of the scientific method

6. give examples of experiments that address unresolved scientific questions using established techniques, methods, or instruments

7. discuss at least two current issues related to how science and technology impact the world, including human society.

For laboratory courses, students should be able to

8a. Appropriately handle and utilize instruments, glassware or other laboratory tools
8b. identify experimental variables, record data and describe observed phenomena using scientific terminology
8c. state how changes in the variables impact results and identify trends and sources of error
8d. logically derive and state valid conclusions from analyzed experimental data

Appendix 2a

CA3 Objective Survey

This survey is to determine how well professors feel they cover CA3 Objectives in their courses.

Professor: _____

Course: _____

Date: _____

How well do you feel you address the CA3 objectives in your course? Please circle the option that you feel fits your instruction best:

1. **Students know the basic concepts and vocabulary of two areas of science or technology and the importance of these areas to modern society**

1	**2**	**3**	**4**
Not at all	Barely	Somewhat	Address very well

2. **Students are familiar with at least two contemporary scientific or technical methods and understand how they are applied to gain scientific or technical knowledge**

1	**2**	**3**	**4**
Not at all	Barely	Somewhat	Address very well

3. **Students are able to explain the conceptual basis of the** *Scientific Method* **, including its definition, motivation, steps of application, hypothesis testing, and misapplications**

1	**2**	**3**	**4**
Not at all	Barely	Somewhat	Address very well

4. **Students can distinguish between science and pseudoscience**

1	**2**	**3**	**4**
Not at all	Barely	Somewhat	Address very well

5. **Students are able to describe a scientific experiment that he or she is familiar with and explain how it applies the steps of the scientific method**

1	**2**	**3**	**4**
Not at all	Barely	Somewhat	Address very well

6. **Students are familiar with some unresolved scientific questions**

1	**2**	**3**	**4**
Not at all	Barely	Somewhat	Address very well

7. **Students are able to analyze debates about the roles science and technology play in shaping the world and human society**

1	**2**	**3**	**4**
Not at all	Barely	Somewhat	Address very well

For Lab Courses:

8. **Students acquire skills associated with scientific inquiry**

1	**2**	**3**	**4**
Not at all	Barely	Somewhat	Address very well

Appendix 2b

CA3 Assessment Survey

This survey is to determine how well professors feel they assess CA3 Objectives in their courses.

Professor: _____

Course: _____

Date: _____

How well do you feel you *assess* the CA3 objectives in your course? Please circle the option that you feel fits your instruction best:

1. **Students know the basic concepts and vocabulary of two areas of science or technology and the importance of these areas to modern society**

1	**2**	**3**	**4**
Not at all	Barely	Somewhat	Assess very well

2. **Students are familiar with at least two contemporary scientific or technical methods and understand how they are applied to gain scientific or technical knowledge**

1	**2**	**3**	**4**
Not at all	Barely	Somewhat	Assess very well

3. **Students are able to explain the conceptual basis of the** *Scientific Method* **, including its definition, motivation, steps of application, hypothesis testing, and misapplications**

1	**2**	**3**	**4**
Not at all	Barely	Somewhat	Assess very well

4. **Students can distinguish between science and pseudoscience**

1	**2**	**3**	**4**
Not at all	Barely	Somewhat	Assess very well

5. **Students are able to describe a scientific experiment that he or she is familiar with and explain how it applies the steps of the scientific method**

1	**2**	**3**	**4**
Not at all	Barely	Somewhat	Assess very well

6. **Students are familiar with some unresolved scientific questions**

1	**2**	**3**	**4**
Not at all	Barely	Somewhat	Assess very well

7. **Students are able to analyze debates about the roles science and technology play in shaping the world and human society**

1	**2**	**3**	**4**
Not at all	Barely	Somewhat	Assess very well

For Lab Courses:

8. **Students acquire skills associated with scientific inquiry**

1	**2**	**3**	**4**
Not at all	Barely	Somewhat	Assess very well

Appendix 3

Individual Course Narratives

BIOL 102: Adam Fry

	Goal 1		Goal 2		Goal 3		Goal 4		Goal 5		Goal 6		Goal 7		Goal 8	
	T	**A**	**T**	**A**	**T**	**A**	**T**	**A**	**T**	**A**	**T**	**A**	**T**	**A**	**T**	**A**
Met	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
SRS	4	4	4	4	2	4	3	3	4	4	3	4	3	4	4	4
GA score		4		4		*2*		3		*3*		3		4		4

T = taught, A = assessed, SRS = Self Rating Scale, GA score = GA rating of assessment. Italics denote negative discrepancy

Adam Fry was interviewed on February 5, 2008 to get a better understanding of how his course addresses the Science and Technology Goals. It is very apparent that he is not only addressing a majority of the learning goals, but addressing them with quite a bit of strength.

Dr. Fry meets Learning Goals 1, 2, and 8 most successfully in his course. He has a strong focus on the fundamental principals of biology and how those principals are important to modern society. For example, his lectures on Anatomy and Evolution often are the springboard to conversations regarding stem cell research, reproduction, cardiovascular issues, and cancer. His lectures often contain relevant, current examples in which he familiarizes students with some contemporary scientific methods and how they play a role in advancing knowledge. His Genetics and Reproduction lectures often include whole class participation to understand the methods used to determine population genetics. The lab sections are also very active in educating students in scientific methods that professional biologists would utilize in experiments.

Dr. Fry does a fairly good job at addressing the other learning goals in his course. Goals 4, 5, 6, and 7 are met mostly through discussion of content that include examples of current events. For example, students are given a non-scientifically-based claim form the media (Learning Goal 4) on the effects of antioxidants on the human life span. He points out to his students that although the media have claimed effects of antioxidants on increasing life span,

there have been no direct studies linking the two together. Through this example, he helps students develop scientific awareness.

Dr. Fry aims to help "all students walk away with a solid foundation in science". In lectures, he provides detailed outlines of topics to be covered to his students which can help with organization and studying. He implements the Learning Cycle (engage, explore, explain, elaborate, and evaluate) into some activities, which can help intensify and deepen learning. Pre-assessments are used to guide his instruction, which helps increase interest in topics. He also uses multiple choice and short answer questions on assessments that make the exams more accessible to multiple learning styles.

Overall, Dr. Fry does an excellent job at meeting the learning goals as well as developing a strong science foundation and interest within his students.

Adam Fry was interviewed for a second time on March 13, 2008 to get a better understanding of how he assesses whether his students are meeting the Science and Technology learning objectives. Dr. Fry demonstrated that he directly assesses some of the GEOC learning goals in his course.

The primary modes of assessment in the course include: exams, lab homework assignments, lab essays and lab note checks. All these forms of assessment have been examined by the GA and illustrated that Dr. Fry assesses Learning Goals 1, 2, 4, 5, 6, 7, & 8 with strength in this course. Learning Goal 3 does not appear to be directly assessed.

Learning Goal 1, content and vocabulary, is heavily emphasized in all of Dr. Fry's assessment methods. Direct evidence of this can be found throughout Exam 1 and Exam 2 as well as through a majority of his Lab Homework Assignments (LHA) and Lab Essays (LE). Dr. Fry also can see if students are then able to relate this content knowledge to modern society through the nature of his exams (E2 #44,45), his LHA (LHA2 #4, LHA10 #1-3, LHA7 #3, LHA5 #5), and his LE (Reproduction, EEB, Diet Analysis, DNA Technology, Plant Diversity, and Cardiovascular Systems).

Dr. Fry also extensively assesses Learning Goal 2, science methods and applications,. Students learn about are DNA, enzyme, and reproductive technologies. They learn most of these methods through their labs and Dr. Fry assesses this learning through the LHA (LHA1 #1-4, LHA2 #1,2, LHA6 #6, LHA7 #2-5, LHA10 #2,4) as well as the LE (DNA Technology, Diet

Analysis, and Cardiovascular System). He also uses exams (E1 #32, E2 #3, 44, 45) and a lab "note check" to assess this learning goal.

Although technology and methods are taught and assessed within this course, there is no explicit instruction of Learning Goal 3, the scientific method. Rather, it is embedded in several examples and within the labs. There was no direct assessment found, other than LHA5 #5, of this learning goal, leading to a discrepancy between Dr. Fry's self-evaluation and the GA findings.

Learning Goal 4, science vs. pseudoscience, is assessed to a limited extent. There are questions that ask students to identify or explain strong, good science in and among pseudoscience. This can be seen in the LHA (LHA7 #4, LHA10#3), the LE (Reproduction, Diet Analysis, and Cardiovascular System), and the exam (E2 #11, 20, 33).

Learning Goal 5, the ability to describe a scientific experiment, is directly assessed through LHA (LHA2 #1, 2, LHA6 #5, LHA10 #2) and the exams (E1 #35, E2 #36). Although there is extensive lab work, there does not seem to be equivalent amounts of written assessment, creating a discrepancy between Dr. Fry's evaluation and the GA's findings.

There was also a slight discrepancy found within Learning Goal 6, unresolved scientific questions. The topic is discussed and covered in class by Dr. Fry, but there is moderate assessment of this learning goal. The exams (E2 #8, 36), the LE (DNA Technology, Diet Analysis, and Cardiovascular System), and the LHA (LHA5 #6) are direct assessments used to see if students are reaching this goal.

Not all of the questions identified for Learning Goal 7, how science can impact the world, are direct assessments. However, questions were found within the LHA (LHA2 #3, LHA7 #3,4,5, LHA10 #1-5), the LE (Reproduction, EEB, DNA Technology, Diet Analysis, Plant Diversity, and Cardiovascular System), and an exam (E2 #3,7,10,12,17,26,36,37,39,43,44,45,46, and Extra Credit).

Learning Goal 8, Scientific Inquiry Skills, is well addressed and assessed. Almost all of the LHA, LE, and all of the labs assess scientific inquiry skills within students.

Overall, Dr. Fry assesses most of the Learning Goals well via exams, Lab Homework Assignments, and Lab Essays.

BIOL 103: Lori Smolin

	Goal 1		Goal 2		Goal 3		Goal 4		Goal 5		Goal 6		Goal 7		Goal 8	
	T	**A**	**T**	**A**	**T**	**A**	**T**	**A**	**T**	**A**	**T**	**A**	**T**	**A**	**T**	**A**
Met	✓	✓	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓	✓
SRS	4	4	4	4	3	3	3	3	3	3	4	4	4	4	4	4
GA score		4		4		*2*				*2/3*		*3*		4		4

T = taught, A = assessed, SRS = Self Rating Scale, GA score = GA rating of assessment. Italics denote negative discrepancy

Lori Smolin, the professor for BIOL 103 was interviewed on February 14, 2008 to get a better understanding of how her course addresses the Science and Technology Goals. Dr. Smolin covers all of the GEOC learning goals thoroughly in her course.

Dr. Smolin addresses each goal with great strength in her course. Her strong-content based class, focusing on health and disease, allows for a direct connection to students' lives and experiences. For example, she discusses stem cells in her reproduction section, cancer development as a part of her mitosis unit, nutrition as part of her membrane transport unit, and pandemics and epidemics as part of her infectious disease unit (Learning Goal 1). These content-based discussions are very nicely linked to unresolved scientific questions. She likes to point out what is known versus what is unknown regarding cancer, heart disease, evolution, and antibiotic resistance (Learning Goal 4). Between her lectures on DNA and reproductive technology and her hands-on, case-based, inquiry labs students are able to walk away understanding technology and methods employed by biologists as well as being able to explain several experiments they took part in (Learning Goal 2, 5, and 8). It is also through these labs that students can gain an understanding of the Scientific Method although the steps are not explicitly taught to students (Learning Goal 3). The content knowledge students gain within this class allows them to approach current issues with an understanding of how we shape and impact the world (i.e. correlation between and increase in deer population and the increase of Lyme Disease in humans) (Learning Goal 7).

Overall, Dr. Smolin has done a solid job of addressing all of the GEOC learning thoroughly throughout her course. It is clear she has thoughtfully embedded these goals in each of her units in BIOL 103.

Lori Smolin was interviewed for a second time on March 13, 2008 to get a better understanding of how she assesses whether her students are meeting the Science and Technology learning objectives. Dr. Smolin demonstrated that she directly assesses most of the GEOC learning goals in her course.

The primary mode of assessment within this class is the exams, of which there are four plus a cumulative final exam. In addition to the exams, students are required to complete basic lab reports each week the lab meets. All exams and lab reports have been analyzed by the GEOC GA and have illustrated that Dr. Smolin assesses Learning Goals 1, 2, 4, 6, 7, & 8 with strength. Learning Goals 3 and 5 were found to be assessed less frequently and directly than was estimated by Dr. Smolin.

Learning Goal 1, content and vocabulary, is heavily assessed throughout this course. Through Multiple Choice, Matching, True/False, and Short Answer questions, Dr. Smolin can tell that students understand the material presented through lecture. Many of the exam questions reflect real life context, such as metabolism, cholesterol, birth control, and diabetes. These questions can be seen on Exam (E) 1, #7 and E2 # 2, 4, 19, 20, 27, 30. The ability to connect biology to real life is also measured in the lab reports, such as: Reproduction, Biochemistry. In the Kitchen, Cardiovascular, Nutrition, DNA Detectives, Bacteria, and Medical Detectives.

In addition to assessing content and vocabulary, Dr. Smolin also assesses Learning Goal 2, scientific methods and techniques, quite frequently. It was found by the GA that this Learning Goal was assessed on all of the exams and in a majority of lab reports. She questions students on reproductive technologies, RFLP, and genetic diseases/technologies.

Learning Goal 3, Scientific Method, was found to not be directly assessed. There were no questions on the exams that show a direct assessment of this goal. The labs reflected the steps of the scientific method, but it was not explicit. Students were required to collect data, analyze them, and synthesize a result. This can be seen in Biochemistry in the Kitchen, Chromosomes and Inheritance, and DNA Analysis labs.

Similarly, Learning Goal 4, the ability to distinguish between science and pseudoscience, is not directly assessed; however, there are multiple questions in which selecting the correct

answer out of four options required students to be able to distinguish between what is true science and what isn't. These questions can be seen in E1 # 4,8,9,17,33; E2 #1,3,6,7,11,12,13,20, 21,29,33,35; E4# 2,3,4,6,7,10,11,12,16,32; Final (F) # 4,5,6,8,15,22,27,41,42,46,47 and in the Cardiovascular/Anatomy Lab and the Nutrition Lab.

A discrepancy between the Professor Self-Rating Scale and the materials analyzed was found in Learning Goal 5, describing a scientific experiment,. There were perhaps one or two questions on the exams that could require students to think of the outcome of an experiment taught in lecture, but no questions that directly assessed this learning goal. Some of the labs required students to go back and solve an unknown such as: Reproduction, Cardiovascular/ Anatomy, Nutrition, Chromosomes and Inheritance, and DNA Analysis; however, there was no requirement for students to describe an experiment they were familiar with.

There was also a slight discrepancy found within Learning Goal 6, unresolved scientific questions, but not sufficient to say that Dr. Smolin is not assessing this learning goal. On the exams, Dr. Smolin asks questions regarding ethics of human genomes, environmental quandaries, and infectious diseases. These can be seen in E1 #13, 14; E2 # 27; E3 # 6, 12. The Nutrition, DNA Analysis, and DNA Detective lab reports also can be used in assessing this goal.

To assess Learning Goal 7, how science can impact the world, Dr. Smolin asks questions regarding human impact on the environment, advances in technology, and disease. It is very well assessed and can be seen throughout all of the exams. Some questions that represent this learning goal are: E1 # 13,14,22,32,33,36; E2 # 4,7,11,13,16,20, 27, 32; E3 # 2,9,11,12,20, 24,27,29, 30-36; E4 # 6,8,9,11,29,31,32,33,34; F # 6,8,13,15,22,27,28,30,34,36,37,38,40-42. This learning goal is also assessed through the lab reports from the Reproduction, Cardiovascular/Anatomy, Nutrition, Chromosome and Inheritance, DNA Analysis, DNA Detective, and Virus Growth labs.

Learning Goal 8, discusses scientific inquiry. Dr. Smolin assesses this goal very well throughout all of her labs. Although students don't select which experiments and topics they are going to do, students are encouraged to collect data, analyze it, and synthesize a conclusion.

Overall, Dr. Smolin assesses a majority of the learning goals with strength.

COGS201: Whitney Tabor and Thomas Bontly

	Goal 1		Goal 2		Goal 3		Goal 4		Goal 5		Goal 6		Goal 7		Goal 8	
	T	**A**	**T**	**A**	**T**	**A**	**T**	**A**	**T**	**A**	**T**	**A**	**T**	**A**	**T**	**A**
Met	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			
SRS	4	4	4	4	4	3	3	3	4	4	4	4	3	2	n/a	n/a
GA score		4		4		3		3		4		*3*		2		

T = taught, A = assessed, SRS = Self Rating Scale, GA score = GA rating of assessment. Italics denote negative discrepancy

Whitney Tabor and Thomas Bontly, the professors for COGS 201 were interviewed on March 7, 2008 to get a better understanding of how their course addresses the Science and Technology Goals. Dr. Tabor and Dr. Bontly clearly meet all of the GEOC learning goals with strength in their course.

COGS 201 has recently been redesigned to be offered as a CA3 course and through the interview with Dr. Tabor and Dr. Bontly, it was made clear that they have made strong attempts to address all of the learning goals. Learning Goals 1, 2, 3, and 6 are claimed to be met with the most strength by Dr. Tabor and Dr. Bontly. By presenting Cognitive Science theories, empirical methods, and models, such as the Computational Mind Theory, Neuroscience, Language, and Evolutionary/Ecological Psychology and Cognition, the professors address Learning Goals 1 and 2. They then use these theories, models, and methods to promote the understanding of the Scientific Method (Learning Goal 3). Students are required to use this knowledge of both COGS content and the Scientific Method to invent hypotheses and create experiments, which are then submitted as problem sets and discussed in class (Learning Goal 5). Along with these problem sets, Tabor and Bontly spend time discussing unresolved questions (Learning Goal 6). COGS is a relatively new science that encompasses several disciplines and there are areas that are still being explored and discussed by scientists and their students. For example, they discuss the mind modular and the role of nature vs. nurture in the acquisition of knowledge. They also claim to use these unresolved questions to distinguish the difference between science and pseudoscience (Learning Goal 4) (e.g. evolution vs. creationism). They feel that they do not do this with as much strength as other aspects of their course. They also feel that they don't do as strong as a job

in discussing how science impacts the world (Learning Goal 7). They do meet this goal through discussing the computational mind and through relevant technologies such as, Artificial Intelligence, Neuroscience, and the Internet.

Overall, Dr. Tabor and Dr. Bontly met all of the goals with great strength in their course.

Whitney Tabor and Thomas Bontly, the professors for COGS 201 were interviewed on March 7, 2008 to get a better understanding of how they assess whether their students are meeting the Science and Technology learning objectives. Dr. Tabor and Dr. Bontly demonstrated that they assess most of the GEOC learning goals with strength in their course.

The primary modes of assessment in the course include: problem sets, midterm and final exam, and participation. The learning goals that are assessed most thoruoughly are Learning Goals 1, 2, & 4. Goals 3, 4, & 5 are also assessed but with not as much strength.

Learning Goal 1, content knowledge and vocabulary, is assessed quite thoroughly in this course. It is done through Short Answer (SA) questions on the midterm exam that measure a deep understanding of COGS methods and models while the Multiple Choice (MC) and True/False (T/F) measure basic knowledge of COGS. The Problem Sets (PS) require students to apply the methods and models of COGS to situations that mirror real life.

Learning Goal 2, COGS methods, is measured on the SA and MC on the midterm. These questions (SA 1, 3) ask students to apply the methods and tools they have learned about in the course. Similarly, the PS are used to measure the same thing. For example, PS2 #3, 4 ask students to apply scientific reasoning and PS3 and 4 ask students to create experiments and make sets of grammar rules based off of the information given. These problem sets are then discussed in class, which provides Tabor and Bontly an informal assessment of students' learning of methods used in Cognitive Science.

Learning Goal 3, Scientific Method, is assessed in much the same way. Tabor and Bontly feel they have a more difficult time measuring this though. They find is easier to assess this through the Problem Sets, in PS3 in particular. Here, students are asked to create an experiment to test a claim. On the midterm exam, MC 2 asks students to define "falsifiability" in regards to Popper's Theories that they learned in the Philosophy of Science.

Learning Goal 5, describing a scientific experiment, is assessed similarly to Learning Goal 3: through Problem Sets and Participation. Tabor and Bontly felt that it was difficult to assess this because COGS is not a traditional science. There are not stereotypical experiments

that occur, but rather models and theories. Students are assessed on their ability to apply theses models and theories to situations.

The professors also find it difficult to assess the difference between science and pseudoscience, Learning Goal 4. They tend to discuss what is known versus what is unknown in COGS and measure this via exams and problem sets. On the exams, they ask students to explain why predictions may or may not check out using what is known in COGS (SA 1, 2). Using PS, they do something similar as seen in PS1 #3, PS2 #3, 4, and PS3 #3.

However, they find it much easier to assess Learning Goal 6, unresolved scientific questions. There was a small discrepancy between the professors' claims of their amount of assessment of this learning goal and the evidence found by the GA. There are several questions on the exam (SA #2, MC #3) and Problem Sets (PS1 #3, PS2 #3, 5) that ask students to address some methods and materials that are still unresolved in the Cognitive Science field.

Although they might discuss resolved and unresolved questions in the course and how these findings can impact the world, there is little assessment of Learning Goal 7. There is one question on the exam (MC#3) that asks students to meet this goal and the problem sets bring up this issue in discussion; however, the professors acknowledge they barely measure it.

Overall, Dr. Tabor and Dr. Bontly do a fairly strong job at assessing how students are meeting the learning goals through a variety of methods that require both low and high-order thinking on the students' part.

EEB 202: Carl Schlichting

	Goal 1		Goal 2		Goal 3		Goal 4		Goal 5		Goal 6		Goal 7		Goal 8	
	T	**A**	**T**	**A**	**T**	**A**	**T**	**A**	**T**	**A**	**T**	**A**	**T**	**A**	**T**	**A**
Met	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
SRS	4	4	3	3	3	4	4	4	4	3	4	3	3	3	n/a	n/a
GA score		4		3		*3*		*3*		3		3		**4**		

T = taught, A = assessed, SRS = Self Rating Scale, GA score = GA rating of assessment. Italics denotes negative discrepancy, bold denotes positive discrepancy

Carl Schlichting, the professor for EEB 202 was interviewed on February 14, 2008 to get a better understanding of how his course addresses the Science and Technology Goals. Dr. Schlichting meets all of the applicable GEOC learning goals in his course.

Dr. Schlichting's course is new and is still in its developmental stages. This affords him the opportunity to "cater the material to meet students' interests, needs, or questions". Through the multiple approaches to his lecture, Dr. Schlichting makes his genetics and evolution course accessible to many different learners who can then take this information and "use it to interpret what is going on today". His course meets learning goals 1, 4, and 6 very well. He discusses current, unresolved issues such as cultural vs. genetic evolution, breast cancer, nature vs. nurture, race, IQs, genetic genealogies, and human disease. To help students begin to understand how all of these topics are studied, he discusses technologies and methods such as genetic testing, DNA fingerprinting, and probabilities. He also discusses how and where these technologies and methods might be employed through his discussions on hypothesis testing, data collection, and falsification of data; however, he doesn't directly teach the steps of the Scientific Method. It is, however, in one of his reading assignments at the beginning of the semester.

Dr. Schlichting uses multiple instructional activities to demonstrate concepts, such as the game Telephone to illustrate genetic mutation or by presenting a hypothesis on the board along with two sets of data and asking students to come up with an analysis or conclusion (i.e. IQ Hypothesis). He is also in the process of developing activities (to be completed at home) where students will have to take a topic, analyze and debate, and come to a conclusion.

Overall, Dr. Schlichting meets all of the learning goals with strength in his course.

Carl Schlichting, the professor for EEB202 was interviewed on March 26, 2008 to get a better understanding of how he assesses whether his students are meeting the Science and Technology learning objectives. Dr. Schlichting has demonstrated that he directly assesses all of the GEOC learning goals in his course.

The primary modes of assessment within this class are several multiple choice exams. Two out of the three exams were provided to the GA via HuskyCT for evaluation. Since this is a new course, the last exam and assignments are still in development. The assignment that was provided for evaluation, meets many of the learning goals. Students are required to evaluate new data and see how it supports or falsifies one of two hypotheses. They are required to read several recent studies and use this new information to support their conclusions. The two exams and assignment were analyzed illustrated that Dr. Schlichting assesses Learning Goals 1-7. There was both positive and negative discrepancies found between the self-rating scale and assessment materials by the GA in Learning Goals 3, 4, & 7.

Learning Goal 1, content and vocabulary, is heavily assessed throughout this course. All of the assessment methods mentioned above are used to see if students are gaining an understanding of concepts and vocabulary, and how this content plays a role in modern society in the form of race and evolution. As the course progresses, students will also be receiving questions on disease susceptibility and nature vs. nurture and how those concepts relate to modern society.

Learning Goal 2, methods and technologies, was also assessed quite well within this course. The technologies and methods that are questioned deal with DNA technologies, PCR (used to multiply DNA), RFLPs, using alleles to predict outcomes, and models. All of the assessment methods evaluated in this course significantly assess this learning goal.

Learning Goal 3 had a slight negative discrepancy because although there were questions on the exams and parts of the assignment that reflected the scientific method, the GA did not feel it sufficient to award a 4. Question #4 on Exam (E)1 that seemed to do a good job at assessing this learning goal and could be made generalizable for the rest of the courses evaluated in this study. This question was: “In science, a well supported explanation of observed facts is known as a: theory, hypothesis, scenario, guess, or falsification.” The assignment assesses this goal indirectly, meaning that students are moving through the steps outlined by the scientific method without actually naming the steps.

Learning Goal 4, distinguishing between science and pseudoscience, also had a slight negative discrepancy, but it is still found to be evaluated through questions on the exams and the assignment that requires students to know what good science requires. These questions are: E1 #2,20,23; E2 #6,16,21,22,23,24,27,39,40, Short Answer C. The assignment asks students to decide what data sets and readings support a hypothesis and what actual science is.

Learning Goal 5, describe a scientific experiment, is indirectly assessed by multiple questions on the exams. These questions reflect models or theories regarding DNA and ancestors that were covered in class. By selecting the correct answer, it can be assumed that they recall the experiment/model. The questions that assess this goal are: E1 # 35, 53; E2 #6, 11, 16, 19,20,21,27, Short Answer C.

Learning Goal 6, unresolved questions, is assessed fairly well, though there was a slight negative discrepancy found by the GA between the self-rated scale and the materials provided. On the exams, questions reflecting a disease or evolution were deemed as unresolved questions, though it was a bit indirect. They can be found on E1 #3,23; E2 #6,9, and Short Answer C. The assignment also assesses this learning goal in that is asks students to look at new data that made a seemingly "resolved" hypothesis unresolved.

Learning Goal 7, how science impacts the world, is assessed very well in this course and has been found to have a positive discrepancy. Dr. Schlichting questions students on information regarding DNA, Alleles, and human history and these topics, in turn, play a role in the modern world. These questions are: E1 #15,17,18,20,25,34,35,47,48,49; E2 #4,5,6,9,10,11,12,21,39,40,41. The assignment also can be used to assess this learning goal in that the data students are applying to hypotheses could "impact" the world.

It was also found that the assignment instills parts of scientific inquiry, Learning Goal 8, by asking students to apply data, research, and generate a new conclusion.

Despite some positive and negative discrepancies, it was found that Dr. Schlichting assesses all of the learning goals within his course quite well.

MARN170: Annelie Skoog

	Goal 1		Goal 2		Goal 3		Goal 4		Goal 5		Goal 6		Goal 7		Goal 8	
	T	**A**	**T**	**A**	**T**	**A**	**T**	**A**	**T**	**A**	**T**	**A**	**T**	**A**	**T**	**A**
Met	✓	✓	✓	✓	✓		✓		✓		✓	✓	✓	✓	✓	✓
SRS	4	4	4	4	3	1	3	2	3	1	4	3	4	4	4	4
GA score		4		4		1		2		**2**		3		4		4

T = taught, A = assessed, SRS = Self Rating Scale, GA score = GA rating of assessment. Bold denotes positive discrepancy.

Annelie Skoog, the professor for MARN 170, was interviewed on February 21, 2008 to get a better understanding of how her course addresses the Science and Technology Goals. Dr. Skoog clearly addresses all of the GEOC learning goals with great strength in her course.

Dr. Skoog's course provides a strong content knowledge of oceanography, its current technologies, its applications to current issues, some unresolved and ongoing research questions, and an exposure to inquiry science. Two main concepts of her course, plate tectonics and ocean circulation, are used to teach three important and current issues: earthquakes, tsunamis, and global warming (Learning Goal 1). Current technologies used quite frequently as examples within her course, are ATOC (Acoustic Thermal of Ocean) and the CO_2 measurement station in Hawaii (Learning Goal 2). Through these examples, she embeds the concept of the Scientific Method (although does not explicitly teach it) and expects students to be able to explain them and how they are impacting current issues (Learning Goals 3, 5, and 7). Some of the unresolved questions that she brings up within her lectures are: global warming-where does the unaccounted CO_2 go?, hydrothermal vents and its communities, unknown deep ocean organisms, and the forces that drive deep water formation (Learning Goal 6). Inquiry is also incorporated into this course via the lab section and the field trip to the head of the Connecticut River with Project O. Here, students collect samples, do chemical and biological determinations on the samples, analyze the data, create graphs and write a final science report (Learning Goal 8).

Dr. Skoog clearly thinks about her students and their learning because her instruction is more than lecture. She often has critical thinking/application in class exercises where students answer questions and apply the information they just learned. They are also encouraged to

discuss/debate the answers with a partner, which furthers the learning that takes place. Her exam format is similar, using what she calls a "pyramid exam." This is when one exam is given to students and they are to work on it alone. The same exam is then given to students and they are allowed to work in pairs and use notes and text to answer the questions. Again, students have to reason and debate the justifications to their answers, which increase learning. The exam score is then weighted 75% the first exam and 25% the second exam.

Overall, Dr. Skoog does a wonderful job at addressing all of the learning goals set out by GEOC with strength.

Annalie Skoog, the professor for MARN 170 was interviewed on March 18, 2008 to get a better understanding of how she assesses whether her students are meeting the Science and Technology learning objectives. Dr. Smolin has demonstrated that she directly assesses four of the seven GEOC learning goals in her course.

The primary modes of assessment within this class are exams, of which there are two-pyramid exams plus a final exam. A pyramid exam is a unique testing method that promotes deep conceptual understanding. It is described on her syllabus as, "two-part exams…You take the first 40-minute section individually without book or notes. You then take the same exam again with a group of students. The second half also takes 40 minutes and you can use notes and book." In addition to the exams, students are required to complete homework questions each week on HuskyCT as well as quizzes. There is a Field Trip Lab Report that all students must complete and for students participating in the lab section of this course, there are basic lab reports. The lab was not evaluated by the GA. Lastly, Dr. Skoog utilizes in-class exercises in which she evaluates conceptual understanding, but counts it towards participation. A midterm exam was provided to the GA for evaluation as well as access to the HuskyCT site in which she was able to evaluate homework assignments. The GA was unable to access the quizzes via HuskyCT for evaluation. The Field Trip Lab Report was also evaluated. From the analysis of the above mentioned materials, it was found that Dr. Skoog assesses Learning Goals 1, 2, 6, and 7 with strength. Learning Goals 3, 4, and 5 were found to be assessed less frequently and directly.

Learning Goal 1, content and vocabulary, is heavily assessed throughout this course. It can be seen throughout the Midterm Exam, Homeworks, and the two in-class participation exercises. Questions regarding global warming, pollution, and eutrophication are used to assess if students can translate the importance of Oceanography to modern society.

Learning Goal 2, scientific methods or technologies, is also assessed very well within this course. On the midterm exam, # 13, 21 are used to assess this learning goal. It is found to be heavily assessed through the Homeworks: H2 #3,4; H3 #6,7; H3.1 # 7,9,10; H4 #1,8,9; H7 #8; H9 #6,7; H10 #8; H11 #7,8; H12 #6,7; H13 #3,4,5; H15 # 5; H16 #5; H18 #9. The Field Trip Lab Report also assesses field research techniques such as, data collection of salinity, hypoxia, sediments biology and requires students to analyze this data in charts and graphs. The in-class participation exercises also assess this learning goal.

Learning Goal 3, 4, & 5 are barely assessed although they are covered in lecture within this course. Learning Goal 5, describe a familiar scientific experiment, was found to have aslightly more assessment by the GA than was claimed by Professor Skoog. This can be seen through Homeworks: H3 #3, H9 #1a, H17 #2. These questions were indirect and are not considered significant enough to say that this learning goal is well assessed.

Learning Goal 6, unresolved scientific questions, is assessed in this course on topics such as, global warming and hydrothermal communities. These topics are assessed mostly through Homeworks: H7 #7; H3.1 #3; H12 #3; H13 #1, 2; H14 #2; H16 #7; H18 #1. It could be assessed also on the other exams, but these were not provided to the GA.

Learning Goal 7, how science impacts the world, is assessed frequently within this course. At the end of each chapter, there are sections that discuss this learning goal through topics such as: maps, minerals on the sea floor, earthquakes, fisheries, and El Nino. These topics are then reflected in the Homeworks: H1 #4; H5 #1,5,7,8; H3.1 #9,10; H9 #1,2,6; H12 #3; H13 # 1,2,3,4,5; H14 #3; H15 #4; H16 # 6,7; H17 #2,4,5. Questions 18, 19 on the midterm exam also assess this learning goal.

Though this does not count as a CA3 lab course, Learning Goal 8, scientific inquiry, is also assessed quite well within this course. All students are required to complete a Field Trip Lab Report based off of their data collection gained from the field trip to UConn-Avery Point on Project Oceanography. They take this data, create charts and graphs, and answer specific questions in which they are required to synthesize an implication. Students who are enrolled in the lab section of this course are also required to complete lab reports every week.

Overall, Dr. Skoog assessed a majority of the learning goals frequently and through a variety of methods.

NUSC165: Hedley Freake

	Goal 1		Goal 2		Goal 3		Goal 4		Goal 5		Goal 6		Goal 7		Goal 8	
	T	**A**	**T**	**A**	**T**	**A**	**T**	**A**	**T**	**A**	**T**	**A**	**T**	**A**	**T**	**A**
Met	✓	✓	✓	✓			✓	✓	✓		✓	✓	✓			
SRS	4	4	2	2	2	2	4	3	3	2	4	3	3	2	n/a	n/a
GA score		4		**3**		*1*		3		2		3		2		

T = taught, A = assessed, SRS = Self Rating Scale, GA score = GA rating of assessment. Italics denotes negative discrepancy, bold denotes positive discrepancy

Hedley Freake, the professor for NUSC 165, was interviewed on February 7, 2008 to get a better understanding of how his course addresses the Science and Technology Goals. It is very apparent that he addresses most of the goals with quite a bit of strength.

Dr. Freake covers learning goals 1, 4, 5, 6, and 7 very well. His course has a heavy and thorough concentration on the fundamental principals of nutrition. It is through this strong nutritional knowledge that he can discuss current and applicable issues such as dietary planning, obesity, and malnutrition. Skill-based, scaffolded dietary planning activities help students put their knowledge gained in lecture into practice (Learning Goals 1 and 2). He also asks students to bring in articles, advertisements, or internet research that make nutritional claims throughout the semester. He uses these opportunities to help students learn how to use their content knowledge to decipher between science and pseudoscience (Learning Goal 4). Discussions in lecture throughout the semester are used at times to not only discuss content but also about the history of nutrition, particularly in the beginning of the semester. This discussion of history aids students in learning about the constant state of change and discovery in science, and thus aids then in understanding some of the current, unresolved issues. Some of these issues that are discussed within this course are: alternative medicines, obesity and optimal diets, and development of cancer and its relationship with diet (Learning Goals 6 and 7). Overall, Dr. Freake addresses many of the learning goals with equal amounts of strength, which is impressive.

Hedley Freake, the professor for NUSC 165 was interviewed on March 11, 2008 to get a better understanding of how he assesses whether his students are meeting the Science and

Technology learning objectives. Dr. Freake has demonstrated that he directly assesses some of the GEOC learning goals in his course.

The primary modes of assessment in the course include: diet analysis assignments, midterm and final exams, and, informally, participation. The diet analysis assignments (DAA) and final exam have been examined by the GEOC GA and have illustrated that Dr. Freake assesses Learning Goals 1, 4, & 6 with the most strength in this course. Learning Goals 3, 5, &7 are not claimed to be directly assessed within this course nor was there evidence demonstrating assessment of these learning goals.

Learning Goal 1, content and vocabulary, is heavily emphasized in all of Dr. Freake's assessment methods. Direct evidence of this can be found throughout the final exam Multiple Choice (MC) and Short Answer (SA) questions as well as through all four of the Diet Analysis Assignments (DAA). Dr. Freake also can see if students are then able to relate this content knowledge to everyday applications through his DAA. Students are required to analyze fictional individual's diets as well as their own. This is seen particularly in DAA2 #8, 17, &18, DAA3 #3b, 8 as well as all of DAA4.

The DAA are primarily used to assess Learning Goal 2, science methods and applications, in this course. There was a discrepancy between the professor evaluation survey and the evidence found by the GA. The GA found more evidence of Learning Goal 2 Assessment than the professor had thought he was doing. Students are required to do calculations, Body Mass Index, provide dietary recommendations, and use nutrient analysis software. This can be seen particularly through DAA1 #3-15, DAA2 #6,8,10,14,&18, DAA3 #1-6, and all of DAA4. There is one question on the final exam that assesses a student's abilities to perform dietary calculations and recommendations (SA 58).

According to Dr. Freake, there is quite a bit of pseudoscience within the field of nutrition and this serves as a large point of engagement for students and a point of assessment for Learning Goal 4, distinguishing between science and pseudoscience. Although there is quite a bit of science vs. pseudo science taught in the course, Dr. Freake chooses to assess dietary recommendations for athletes. This is seen in MC #48-50 and SA #52.

In addition to large amounts of pseudoscience in nutrition, there are also quite a few unresolved questions regarding what are appropriate diets. Dr. Freake assesses this via the Short Answer questions on the final exam (SA #52, 55, 57, 58) as well as through Diet Analysis

Assignment #4. According to Dr. Freake, “good answers to these questions would include the uncertainties posed by the unresolved nutritional questions.”

Overall, Dr. Freake does assess several learning goals with strength and focuses primarily on content and unresolved questions within the field of nutrition.

PHYS103l/104L: Philip Best

	Goal 1		Goal 2		Goal 3		Goal 4		Goal 5		Goal 6		Goal 7		Goal 8	
	T	**A**	**T**	**A**	**T**	**A**	**T**	**A**	**T**	**A**	**T**	**A**	**T**	**A**	**T**	**A**
Met	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
SRS	3	3	3	2	2	4	3	4	1(l)/3(L)	1(l)/3(L)	3	3	3	3	4	4
GA score		4		**3**		*2/3*		***3***		**2(l)/3(L)**		3		**4**		4

T = taught, A = assessed, SRS = Self Rating Scale, GA score = GA rating of assessment. Italics denotes negative discrepancy, bold denotes positive discrepancy

Phil Best, the professor for PHYS 103/104L, was interviewed on February 12, 2008 to get a better understanding of how his courses address the Science and Technology Goals. Dr. Best addresses a majority of the learning goals with moderate strength.

Learning Goals 1, 6, 7 are addressed with the most strength in his lecture course. There are many fundamental physics concepts that are discussed mostly in the first half of the semester. Some of these concepts are: definition of science, energy, electromagnetism, and the states of matter. The second half of the semester discusses how these fundamental concepts are important and applicable to modern, unresolved issues such as nuclear energy, atmospheric pollution, global warming, and creating a sustainable future (Learning Goal 1). His lab course, PHYS 104 also meets learning goals 1, 6, and 7 but also meet learning goals 2, 5, and 8 due to the hands-on activities they participate in. The lab helps students understand contemporary scientific methods used by physicists such as, accurate measuring, calculations, graphing, properties of matter and how two properties are related to each other. These methods are taught through labs involving mass, density, properties, and layering of water. As a result of participating in these labs, students would be more capable of describing an experiment and how it applies the scientific method (Learning Goal 5). These labs also develop inquiry skills as noted in Learning Goal 8.

One question arose about the Self-Rating Scale score of learning goal 4, which states "Students should be able to distinguish between science and pseudoscience." Dr. Best showed one example that he uses at the beginning of the semester to teach students the importance of knowing numbers to determine the integrity of a claim; however, he does not revisit this concept for the rest of the semester. This does illustrate that he is making an attempt to help students

learn to decipher between science and pseudoscience but it is not reinforced throughout the semester. This discrepancy could be caused by the survey-taker's interpretation of the wording provided.

Overall, Dr. Best addresses many of the learning objectives set by the University of Connecticut well and with strength in both his lecture and lab courses.

Phil Best, the professor for PHYS 103/104L was interviewed on March 26, 2008 to get a better understanding of how he assesses whether his students are meeting the Science and Technology learning objectives. Dr. Best has demonstrated that he directly assesses most of the GEOC learning goals in his courses.

The primary mode of assessment within this class is the exams, of which there are two plus a cumulative final exam. Only one midterm exam and a final were provided to the GA for evaluation. In addition to the exams, students that are enrolled in 104 are required to complete basic lab reports each week. In addition, there are quizzes on HuskyCT; however, the GA could not access the quiz questions. Lastly, there are homeworks given for each lecture. These are posted on the syllabus and are within the text book. The GA was not able to access a book for evaluation of these homework questions, but can speculate which learning goals are assessed due to the corresponding lecture topic. All exams, homeworks, and lab reports that have been provided to the GA have been analyzed and illustrated that Dr. Best assesses Learning Goals 1, 2, 3, 4, 5, 6, 7, & 8. There was both positive and negative discrepancies found between the self-rating scale and assessment materials by the GA in Learning Goals 1, 2, 3, 4, 5,& 7.

Learning Goal 1, content and vocabulary, is heavily assessed throughout this course. All of the assessment methods mentioned above are used to see if students are gaining an understanding of physics concepts, vocabulary, and how this content plays a role in modern society in the form of greenhouse gases, thermal inversion and pollution, nuclear energy and safety, and radiation. Dr. Best underestimated his assessment of this learning goal on the self-rated scale, resulting in a positive discrepancy found by the GA.

There was also a positive discrepancy found with Learning Goal 2, methods and technologies. The majority of questions from the exams and labs require conversions, applications of equations, and techniques that are used by physicists daily to advance scientific knowledge. It can be speculated that a majority of the homeworks would also require students to apply conversions and applications to solve problems.

Learning Goal 3 had a slightly negative discrepancy because although there were questions on the exams that reflected the motivation behind science, the definition of science, and what makes for good science, there were no questions that directly assessed the scientific method. These questions were found on Exam (E) 1 #23-26 and the Final (F) # kk, ll. The scientific method was also indirectly assessed through several labs were students were required to reflect on their data and make new recommendations or assumptions. These labs were: Sink/Float and Thermal Properties of matter.

Learning Goal 4, distinguishing between science and pseudoscience, also had a slightly negative discrepancy, but it was still found to be evaluated through questions on the exams that require students to know what good science requires. These questions are: E1 #20-27, 39 and F# kk, ll.

Learning Goal 5, describe a scientific experiment, is directly assessed by one question on the Final Exam: #27 where students are asked to describe a scientific model. The learning goal is indirectly assessed in the lab reports where students are required to take the labs and answer questions where they need to explain a step or a constant. These labs are: Sink/Float, Thermal Properties of Matter, and The Layering of Water.

Learning Goal 6, unresolved questions, is assessed fairly well in this course around topics like global warming, nuclear energy, population growth, and cancer probability. These questions are conceptual and ask students to apply equations and conversions. They can be seen in the Final #4, 5, cc, dd, ee, ff, 22. It is likely questions that assess this learning goal can be found in the Chapter 14 (Energy), 25 (Nuclear/Radiation), & 26 (Nuclear Energy).

Learning Goal 7, how science impacts the world, is assessed very well in this course, more so than claimed by the instructor. Dr. Best questions students on the benefits of science, global warming, and nuclear energy extensively. On the exams, the questions that assessed this learning objective are the following: E1 #8,11,12,15,16,21,32,33; F #2-5, e,i,y,aa,bb,cc,dd,ee,ff,hh,kk,ll,pp,ss,20, 22. The labs that assess this learning goal are Nuclear Radiation and The Effect of Carbon-Dioxide in Air. It can be speculated that Chapter 11 (Fossil Fuels), 12/13 (Thermal Energy), 14 (Available Energy), & 25/26 (Nuclear Energy/Radiation) also assess this learning goal.

Learning Goal 8, scientific inquiry, is assessed very well in the version of this course via the lab reports. Many of the labs require students to collect data, interpret graphs, and present

their work in writing. The labs that appear to assess this learning goal the best are: Sink/Float, Thermal Properties of Matter, Layering of Water, Spectra, Measuring Solar Constant and Sun's Temperature, Effect of Carbon-Dioxide in the Air, and Nuclear Radiation.

Despite some differences between instructor and GA evaluations, it was found that Dr. Best assesses most of the learning goals within the non-lab version and all of them in the lab version of his course.

PHYS 155L: Cynthia Peterson

	Goal 1		Goal 2		Goal 3		Goal 4		Goal 5		Goal 6		Goal 7		Goal 8	
	T	**A**	**T**	**A**	**T**	**A**	**T**	**A**	**T**	**A**	**T**	**A**	**T**	**A**	**T**	**A**
Met	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
SRS	3	3	4	4	3	3	3	4	3	4	3	3/4	3/4	3	4	4
GA score		4		4		*1*		*3*		*3*		*2/3*		**3/4**		4

T = taught, A = assessed, SRS = Self Rating Scale, GA score = GA rating of assessment. Italics denotes negative discrepancy, bold denotes positive discrepancy

Cynthia Peterson, the professor for PHYS 155, was interviewed on February 18, 2008 to get a better understanding of how her course addresses the Science and Technology Goals. Dr. Peterson clearly meets all of the GEOC learning goals thoroughly in her course.

Each GEOC goal is addressed with great strength. Her course has a very strong content base that is often connected to current issues of global warming and solar energy. Students walk away from her class with a knowledge of methods and technology such as spectroscopy, distancing and aging techniques, and telescopes as well as an understanding of how these instruments can and have been used in scientific experiments (Learning Goals 1, 2). Although the steps of these scientific experiments are not explicitly taught, she discusses how scientists arrived at their discoveries, such as: Tycho Brahe, Keppler's Laws, Galileo's heliocentric model, and Bell's pulsars (Learning Goal 3). In addition to covering several important discoveries in astronomy, she also discusses unresolved scientific questions (Learning Goal 6) such as cosmology, dark energy, and existing planets outside of the solar system and current issues (Learning Goal 7) such as the Big Bang and the development of technologies for food, computers, and medicine. Her lab course includes many labs, all of which are hands-on, inquiry based activities. Students are required to do data collection using scientific techniques, apply formulas to them, and analyze their results.

Dr. Peterson also has a course website (astronomy.uconn.edu) from which students can access many different and interesting astronomy links, study guides, weekly work problems, class notes, vocabulary terms, test reviews. One of the links helps students learn how to decipher

between science and pseudoscience (Learning Goal 4). There is a fact page about purchasing stars that is very helpful in helping students realize what their money is buying.

Overall, Dr. Peterson addresses all of the learning objectives with depth and strength.

Cynthia Peterson, the professor for PHYS 155 was interviewed on March 19, 2008 to get a better understanding of how she assesses whether her students are meeting the Science and Technology learning objectives. Dr. Peterson has demonstrated that she directly assesses a majority of the GEOC learning goals in her course.

The primary mode of assessment within this class is the exams, of which there are three plus a cumulative final exam. In addition to the exams, students that are enrolled in the lab section are required to complete basic lab reports each week as well as observation reports from the times they go to the Observatory. All exams and lab reports provided to the GA have been analyzed and illustrated that Dr. Peterson assesses Learning Goals 1, 2, 4, 5, 6, 7, & 8. There were both positive and negative discrepancies found between the self-rating scale and assessment by the GA in Learning Goals 1, 3, 4, 5, 6, & 7.

Learning Goal 1, content and vocabulary, is heavily assessed throughout this course. All of the assessment methods mentioned above are used to see if students are gaining an understanding of physics concepts, vocabulary, and how this content plays a role in modern society in the form of moon phases, eclipses, geocentric to heliocentric models, star charts, calculations, and the expansion of the Earth. Dr. Peterson underestimated her assessment of this learning goal on the self-rated scale.

Learning Goal 2, methods and technologies, was found to be assessed heavily in all exams and labs. The questions reflecting this learning goal were about calculations and equations, telescopes, spectrums, star charts, and orreries.

Learning Goal 3 had a negative discrepancy between the self-rated scale and the GA findings. A possibility why this discrepancy occurred is that Dr. Peterson had a different understanding of the learning goal than the GA. Dr. Peterson mentioned in the interview there were quite a few questions that had an imbedded implication of the scientific method; however, the GA was unable to find any within the materials provided for evaluation.

Learning Goal 4, distinguishing between science and pseudoscience, also had a slightly negative discrepancy, but it was evaluated through questions on the exams that require students to be able to distinguish between things good science has produced vs. pseudoscience. Some

topics these questions reference are: Earth's continual expansion, proof of Earth's rotation, shadows, and moon theory. An excellent question that could be applied across many GEOC courses found for this learning goal is on the Final (F) #11, where Dr. Peterson asking students to select a proof from several others of a phenomenon. The other questions that assess this goal are: E1 #2, 23, 34; E2 #7, 12, 16; E3 # 6, 28, 33; F# 11,69,71,75.

Learning Goal 5, describe a scientific experiment, is indirectly assessed by questions referencing models or laws in astronomy. Students are not asked to explain the steps of the scientific method. These questions are found in: E1 #31, 32; E2 # 32, 35, 36, 37, 37, 38, 39; E3 # 6, 7; F# 20,42,44,49,50,51,63, 76-80. This learning goal is well assessed through the Observation Reports students must write after spending time at the Observatory.

Learning Goal 6, unresolved questions, is assessed in this course with questions regarding water on the moon, life in space, and moon generation theory. These questions were: E2 #12, 16; E3# 28, 33, 34; F #75. There was a negative discrepancy between the self-rated scale and the finding of the GA with this learning goal due to the limited number of relevant questions asked.

Learning Goal 7, how science impacts the world, is assessed very well in this course, more so than claimed by the instructor. By questioning students on star charts, estimated times of star sightings and eclipses, origins of seasons, and current moon generation theory, Dr. Peterson can see if students understand some of the concepts covered in her course. These questions are: E1 #1,5,18,20; E2 #5,12,16,35-39; E3 #4,6,7,33,34,38; F #5,6,20,21,22,23,25,32,33,63,70,72,75. Question #72 on the Final is a great question that could be applied in all GEOC courses. Here, Dr. Peterson asks students to select what a certain question being debated today concerns.

Learning Goal 8, scientific inquiry, is assessed very well in this course via the lab reports completed by students. Many of the labs require students to collect data and measurements, graph these data, and calculate answers. The students are not asked to generate any new information based off on these data. The labs that appear to assess this learning goal the best are: Observation Reports, Celestial Sphere, Finding Stars and Constellations, The Sun, Telescope, Finding the Planets, The Spectrum, Double Stars, Crab Nebula, The Solar System, Finding Celestial Objects, and Telescopic Reduction.

Despite some positive and negative discrepancies, it was found that Dr. Peterson assesses a majority of the learning goals within her course.

PSYC132: James Chrobak

	Goal 1		Goal 2		Goal 3		Goal 4		Goal 5		Goal 6		Goal 7		Goal 8	
	T	**A**	**T**	**A**	**T**	**A**	**T**	**A**	**T**	**A**	**T**	**A**	**T**	**A**	**T**	**A**
Met	✓	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓	✓
SRS	3	4	3	3	2	3	4	4	3	3	2	3	3	2	4	3
GA score		4		3		**4**		*2/3*		**3/4**		*1/2*		**2/3**		**4**

T = taught, A = assessed, SRS = Self Rating Scale, GA score = GA rating of assessment. Italics denotes negative discrepancy, bold denotes positive discrepancy

James Chrobak, the professor for PSYCH 132, was interviewed on February 19, 2008 to get a better understanding of how his course addresses the Science and Technology Goals. Dr. Chrobak meets several of the GEOC learning goals well in his course.

Through this interview with Dr. Chrobak, it has been found that he meets Learning Goals 4 and 8 (although this is not a CA3 lab course) with the most strength and goals 1, 2, 5, and 7 with a strong focus. Learning Goals 4 and 8 are both met through his last, and most important, lab, entitled the "Literacy Lab." In this lab, students are required to locate a research article using the library and analyze it by identifying the independent and dependent variables, how the experiment was carried out, the results, as well as the integrity of the article. This helps students learn about a current experiment (Learning Goal 5), how to decipher between science and pseudoscience, and how researchers go about their work. The content knowledge and methodologies provided within the course also supplement the students' knowledge of research. Dr. Chrobak focuses primarily on drugs and humans and discusses methods such as neuro-imaging and genetics as well as how these debates are dealt with in society (Learning Goals 1, 2, and 7). Although students are performing simple data collection in labs and are required to analyze a current experiement, they are not explicitly taught the scientific method and its application to current research.

Dr. Chrobak also has a website on which he has his syllabus, expectations, course notes, and test reviews. This is a helpful addition for his students. Overall, Dr. Chrobak meets a majority of the learning goals with strength in his course.

James Chrobak, the professor for PSYC 132 was interviewed on April 3, 2008 to get a better understanding of how he assesses whether his students are meeting the Science and Technology learning objectives. Dr. Chrobak has demonstrated that he directly assesses a majority of the GEOC learning goals in his course.

The primary mode of assessment within this class is the exams, of which there are two plus a final exam. In addition to the exams, students are required to complete basic labs, in which a Science Literacy Lab Report is mandatory. It is typically up to the Teaching Assistants to decide whether students will need to turn in extra lab reports, so it varies among lab sections. The Science Literacy Lab Report asks students to review several Peer Reviewed Journals and write a report that identifies the purpose of the study, the Independent and Dependent Variables, the methods, and the findings. At the last lab, students are asked to briefly share the study they reviewed. All exams and labs that have been provided to the GA have been analyzed and illustrated that Dr. Chrobak assesses Learning Goals 1, 2, 3, 5, 7, & 8. There was both positive and negative discrepancies found between the self-rating scale and assessment by the GA for Learning Goals 3, 4, 5, 6, 7, & 8.

Learning Goal 1, content and vocabulary, is heavily assessed throughout this course. All of the assessment methods mentioned above are used to see if students are gaining an understanding of concepts, vocabulary, and how this content plays a role in modern society in the form of drug policy, experimental methods, and psychological disorders.

Learning Goal 2, methods and technologies, was found to be assessed heavily in all exams and labs. The questions reflecting this learning goal were about statistical analysis and FMRI. These questions were found in Exam (E)1 #6,13,17,19,28; E2 #17,23,24,25; F #3,19,21,33. The labs, depending on whether TAs require a lab report, could also assess this learning goal. Almost all of the labs require data collection and statistical analysis. The required Science Literacy Lab Report can be used to directly assess if students are getting a grasp of this learning goal.

Learning Goal 3, scientific method, had a positive discrepancy between the self-rated scale and the GA findings. Dr. Chrobak inserts sample experiments on his exams and asks a series of questions that reflect the scientific method. This kind of questioning could be applied across all GEOC courses. The questions that assess this learning goal can be found on E1 #6,9,10, 14-20 , 35-39 ; E2 # 13-18, 19; F #3, 14-19, 29, 31-34.

Learning Goal 4, distinguishing between science and pseudoscience, had a negative discrepancy. It is questionable if this learning goal is truly assessed in this course. The questions found require students to be able to identify national organizations that deem an experiment as "good science" using the standards of, peer review. The questions found to assess this goal are: E2 #18, F #9. The Science Literary Lab Report requires students to identify experiments that have been passed by peer review.

Learning Goal 5, describe a scientific experiment, was found to have a positive discrepancy. Like Learning Goal 3, Learning Goal 5 is assessed by the inserted experiments and following questions. These questions are found in: E1 # 1, 14-20, 27, 35-39; E2 # 13-18; F #14-19, 31-34. The Science Literacy Lab Report also is used to assess this goal. Dr. Chrobak mentioned in his interview that he also assigns an extra-credit problem in his class where students are asked to design an experiment and identify the Independent and Dependent Variables, the purpose, and the methods.

Learning Goal 6, unresolved questions, had a negative discrepancy between the self-rated scale and the GA Findings. A reason for this could be because the GA was unaware of the unresolved issues Dr. Chrobak felt he was assessing. The only question found was E1 #27.

Learning Goal 7, how science impacts the world, was found to have a slightly positive discrepancy. The questions used to assess this learning goal were on the topics of drugs and their implications or disorders. They were found in E1 # 1, 24, 31; E2 #23, 24, 25, 35, 37; F # 5,9,37.

Learning Goal 8, scientific inquiry, is assessed very well in this course via the Science Literacy Lab Report. All of the other labs reflect scientific inquiry processes and depending upon the TA, these labs could serve as assessment forms. Each TA is also required to design a Lab Final for their section, and although it was not provided for evaluation, it can be deemed that this is a strong assessment method for this learning goal Since PSYC 132 is not a CA3 lab course, it is not expected to meet Learning Goal 8.

Despite some positive and negative discrepancies, it was found that Dr. Chrobak assesses a majority of the learning goals within his course.

Appendix 4

Science Interest and Self-Efficacy:
SD= Strongly Disagree D= Disagree N= Neither A= Agree SA= Strongly Agree

1. After taking a CA3 Course, I am confident that I understand or can answer questions on:

	SD	D	N	A	SA
1. Basic concepts and vocabulary taught in the course					
2. The methods and technologies utilized by scientists in the field					
3. The Scientific Method and its application					
4. The difference between science and pseudoscience					
5. The conduct of a scientific experiment I am familiar with					
6. Unresolved questions in the field of science					
7. How science impacts the world					

2. After taking a CA3 Course, I am confident that I can apply my science knowledge to events in life and in the news

SD D N A SA

3. By taking a lab course, I think that I built on old skills and/ or gained new science skills

SD D N A SA

4. I like science more after taking a CA3 Course

SD D N A SA

5. I find it difficult to understand current scientific events in life or in the news

SD D N A SA

6. After taking a CA3 Course, I am more interested in science and will seek out more information regarding this topic

SD D N A SA

6a. I will likely seek out more information through:

__ Another course
__ Internet
__ News/ Media
__ Other:

__ I will not seek out more information