

Science General Education Annual Assessment Report 2007-2008

I. Introduction

The Science General Education Program serves all OIT degree students, who are required to complete 12 science credits selected by the student or specified by the major department.

II. Program Purpose, Objectives and Student Learning Outcomes

The faculty in the Natural Science Department who are part of the Science General Education Program met twice in October to review and rewrite our Science General Education program purpose, objectives, and student learning outcomes. We also developed a curriculum map for the program and selected the courses and years that each outcome would be evaluated, developing a matrix for evaluating our program student outcomes.

Science General Education Program Purpose

To provide lower division science courses appropriate for science, technology, engineering, health, and liberal arts students.

Program Educational Objectives

1. Understanding of fundamental scientific principles or concepts.
2. The ability to apply fundamental principles or concepts to solve problems.

Expected Program Learning Objectives

1. Students will demonstrate factual knowledge gained in the sciences (terminology, organization, classifications, methods, fundamental principles, generalizations, or theories).
2. Students will demonstrate problem solving skills using college level mathematics.
3. Students will be able to record and analyze data necessary to demonstrate a fundamental principle.
4. Students will be able to use theories and models as unifying principles that help us understand natural phenomena.

III. Three Year Cycle for Assessment of Student Learning Outcomes

The faculty agreed on a three year cycle of assessment of the four program learning outcomes, as listed in table 1 below.

Learning Outcomes	'07-08	'08-09	'09-10
Students will demonstrate factual knowledge gained in the sciences (terminology, organization, classifications, methods, fundamental principles, generalizations, or theories).	X		
Students will demonstrate problem solving skills using college level mathematics.		X	
Students will be able to record and analyze data necessary to demonstrate a fundamental principle.		X	
Students will be able to use theories and models as unifying principles that help us understand natural phenomena.			X

Table 1. Science General Education Assessment Cycle

IV. Summary of 2007-08 Assessment Activities

In this first year of assessment, the Science General Education program faculty assessed student learning outcome one: **students will demonstrate factual knowledge gained in the sciences (terminology, organization, classifications, methods, fundamental principles, generalizations, or theories)**. This was done in two courses, with significant enrollment, in the science general education program: CHE 101 Elementary Chemistry (fall and winter quarters) and BIO 231 and BIO 232 Human Anatomy and Physiology (fall and winter quarters respectively). (See Appendix A for a list of courses found in the general science curriculum).

CHE 101 Elementary Chemistry fall 2007

1. Direct Method: A common exam was administered to three sections of CHE 101 Elementary Chemistry for a total of 96 students. The results are summarized in table 2 below.

Performance Criteria	Assessment Methods	Measurement Scale	Minimum Acceptable Performance	Results
Terminology	Common Final (3 lecture sections)	Weighted points for various questions	% Total Category Value of 0.75 (75%)	Exceeded Minimum Acceptable Performance (0.84)
Methods	Common Final (3 lecture sections)	Weighted points for various questions	% Total Category Value of 0.75 (75%)	Exceeded Minimum Acceptable Performance (0.805)
Organization	Common Final (3 lecture sections)	Weighted points for various questions	% Total Category Value of 0.75 (75%)	Slightly Below Minimum Acceptable Performance (0.736)

Table 2. Summary of data for direct measure for learning outcome one from CHE 101 Elementary Chemistry fall term 2007.

Three questions from three categories (terminology, methods, and organization) were assessed using a weighted point measurement scale. The minimum acceptable performance for each category was 75% of the total category value. The terminology and methods categories exceeded the minimum acceptable performance with an 84% and 80.5 % total category value, respectively. The organization category is slightly below the minimum acceptable performance with a 73.6 % total category value. There were no apparent differences amongst category results between the three lecture sections.

Most students enrolled in Chemistry 101 are in their first term of their college career. Thus, study skills are in development. Organizational questions build upon the basic knowledge from terminology and methods and therefore are expected to be, on average, lower than either of these categories. To help increase performance in the organization category, however, more organizational questions were administered winter term for extra practice. In addition, the assessment method used for Fall 2007 was repeated in Winter 2008 and the results are compared in section VI of this report.

2. Indirect Method

Data from the IDEA Center Faculty Evaluations was used to evaluate students' perceptions relative to the instructors perception of the primary learning outcomes for the course. IDEA learning outcome number one and number two were identified by all faculty as essential learning outcomes for the course and are as follows:

1. Gaining factual knowledge (terminology, classifications, methods, trends)
2. Learning fundamental principles, generalizations, or theories.

Students rated the importance of these outcomes on a 5-point scale (1 - no apparent progress; 5 - exceptional progress). Table 3 below compiles the results of this indirect assessment.

Essential Learning Outcomes	Average (5 – point scale)		% of Students Rating	
	Raw	Adjusted	1 or 2	4 or 5
(1) Section 01	4.1	4.2	3 %	79 %
Section 02	4.7	4.6	0 %	100 %
Section 03	4.2	4.3	4 %	85 %
Average	4.3	4.4	2.3 %	88 %
(2) Section 01	4.2	4.3	3 %	86 %
Section 02	4.6	4.4	0 %	94 %
Section 03	4.3	4.4	0 %	89 %
Average	4.4	4.4	1 %	90 %

Table 3. Results of Indirect Assessment of CHE 101 (Elementary Chemistry)

The average score for learning outcomes 1 and 2 are 4.3/4.4 and 4.4/4.4, respectively. The first number indicates the raw (or unadjusted) score and the second indicates the adjusted score. The latter makes classes more comparable by considering factors that influence student ratings yet are beyond the instructor's control (ex. student desire to take the course or student work habits). The percent of students rating is also reported. Only 2.3 % of students rated learning outcome one as 1 or 2 (no or slight progress) while 88 % of students rated the outcome as 4 or 5 (substantial or exceptional progress). One percent of students rated learning outcome two as 1 or 2 (no or slight progress) while 90% of students rated the outcome as 4 or 5 (substantial or exceptional progress).

The high student evaluation of these two objectives indicates a concordance between student perceived learning and the actual learning outcome as indicated in the direct assessment.

Detailed results of this assessment are available in the Natural Sciences Assessment notebook.

BIO 231 Human Anatomy and Physiology fall term 2007

I. Direct Method #1: A common exam was administered to four sections of BIO 231, Human Anatomy and Physiology for a total of 178 students. The results are summarized in table 4 below.

Overall:

	% correct	minimum acceptable performance
Terminology	81%	75%
Classification	65%	65%
Organization	68%	65%
Fundamental principles	65%	65%

Table 4. Results of direct assessment BIO 231 fall term.

Questions from four categories (terminology, classification, organization, and fundamental principles) were assessed for the percent of students that answered the questions correctly. The minimum acceptable performance for each category is 75% for terminology, and 65% for classification, organization, and fundamental principles.

The terminology and organization categories exceeded the minimum acceptable performance with an 81% and 68% total category value, respectively. The first term of anatomy and physiology focuses on terminology, so the 81% correct rate in this category, although it exceeds expected performance, is not surprising. Expectations were met in both the classification and fundamental principle categories at 65% correct in both.

Students come with different levels of preparation and commitment, and as there is no prerequisite for the first course in the sequence, a number of students will elect to change majors at the end of the term. The expectations for students are higher in the second and third terms as they are more evenly prepared. In winter and spring terms in BIO 232 and 233, we have higher expectations in the more difficult categories of learning as they can build on the material from the previous term and they are better prepared for the effort required to be successful.

Detailed results of this assessment are available in the Natural Sciences Assessment notebook.

BIO 232 Human Anatomy and Physiology winter term 2008

I. Direct Method #2: A common exam was administered to four sections of BIO 232, Human Anatomy and Physiology for a total of 160 students. The results are summarized in table 5 below.

Overall:

	% correct	minimum acceptable performance
Terminology	83%	75%
Classification	71%	70%
Organization	75%	70%
Fundamental principles	72%	70%

Table 5. Results of direct assessment BIO 232 winter term.

Questions from four categories (terminology, classification, organization, and fundamental principles) were assessed for the percent of students that answered the questions correctly. The minimum acceptable performance for each category is 75% for terminology, and 70% for classification, organization, and fundamental principles.

In winter and spring terms in BIO 232 and 233, we have higher expectations in the more difficult categories of learning as they can build on the material from previous term and they are better prepared for the effort required to be successful. As predicted, students met or exceeded increased expectations in all categories, as students in the second and third terms are more evenly prepared, and have developed appropriate study habits.

Additional Assessment Winter Term 2008

Institutional Student Learning Outcome (ISLO) assessment for critical thinking and problem solving which includes the following criteria:

1. Identifies and explains **problem/question/issue**
2. Recognizes stakeholders and **contexts** (i.e., cultural, social, educational, technological, political, scientific, economic, ethical, personal experience)
3. Frames personal responses and/or acknowledges other **perspectives**
4. Evaluates **assumptions**
5. Evaluates **evidence**
6. Evaluates **implications**, conclusions, and consequences.

I. Direct method. A common assignment was used to evaluate critical thinking in three sections of BIO 212 Principles of Biology laboratories for a total forty students. The results are summarized in table 6 on the following page.

Performance Criteria	Assessment Methods	Measurement Scale	Minimum Acceptable Performance	Results
1. Identifies and explains problem/question/issue	Rubric	1 - 4, % at 3 or 4	Baseline data	75
2. Recognizes stakeholders and contexts	Rubric	1 - 4, % at 3 or 4	Baseline data	47
3. Frames personal responses and/or acknowledges other perspectives	Rubric	1 - 4, % at 3 or 4	Baseline data	42
4. Evaluates assumptions	Rubric	1 - 4, % at 3 or 4	Baseline data	42
5. Evaluates evidence	Rubric	1 - 4, % at 3 or 4	Baseline data	22
6. Evaluates implications, conclusions, and consequences	Rubric	1 - 4, % at 3 or 4	Baseline data	72

Table 6. Results of critical thinking assessment BIO 212 Principles of Biology Laboratory winter term 2008.

Students were assigned a poster presentation on a controversial topic. (Project assignment and grading sheets are available in the General Science Education Program assessment binder.) Students were then evaluated using a rubric developed by the institution (see General Science Education Program assessment binder for a copy of the rubric). For each criterion a student was scored on a proficiency scale of 1-4:

- 1 no/limited proficiency
- 2 some proficiency
3. proficiency
4. high proficiency

Students did not receive a copy of the rubric by which critical thinking was being evaluated although they did receive a copy of the grading sheet prior to their presentations.

This assessment was to gather baseline data for critical thinking skills. BIO 212 students are usually freshman or sophomores, and come to college with varied experience in critical thinking. Students were not given the rubric prior to their presentations. It might be interesting to see if students would perform better if they had the evaluation rubric when the assignment was given.

V. Evidence of Student Learning

Student learning Outcome #1: students will demonstrate factual knowledge gained in the sciences (terminology, organization, classifications, methods, fundamental principles, generalizations, or theories). (Generalizations and theories were not evaluated in this assessment cycle.)

Strengths: Students in the general science education courses performed at or above expectations in most performance criteria including: terminology, classification, methods, and fundamental principles. For the most part, students were also performing at or above expectations in the area of organization.

Areas needing improvement: In fall term 2007, it was noted in the CHE 101 assessment that students did not meet minimum acceptable performance in the area of organization. Faculty decided to give additional practice in this area winter term 2008, followed by reassessment. With the additional practice, students in CHE 101 slightly exceeded minimum requirements in organization.

VI. Changes Resulting from Assessment

CHE 101 Elementary Chemistry winter 2008

1. Direct Method: Winter term 2008, CHE 101 was reassessed after implementing more practice in the area of organization. The same exam that was administered to three sections of CHE 101 Elementary Chemistry fall term 2007 was again administered to the single section of CHE 101 students in winter term 2008 for a total of 44 students. The results are summarized in table 7 below.

Performance Criteria	Assessment Methods	Measurement Scale	Minimum Acceptable Performance	Results
Terminology	Final 1 lecture section	Weighted points for various questions	% Total Category Value of 0.75 (75%)	Exceeded Minimum Acceptable Performance (0.882)
Methods	Final 1 lecture section	Weighted points for various questions	% Total Category Value of 0.75 (75%)	Exceeded Minimum Acceptable Performance (0.802)
Organization	Final 1 lecture section	Weighted points for various questions	% Total Category Value of 0.75 (75%)	Slightly Above Minimum Acceptable Performance (0.774)

Table 7 . Summary of data for direct measure for learning outcome one from CHE 101 Elementary Chemistry winter term 2008.

Three questions from three categories (terminology, methods, and organization) were again assessed using a weighted point measurement scale. The minimum acceptable performance for each category is 75% of the total category value. The terminology, methods, and organization categories exceeded the minimum acceptable performance with an 88.2%, 80.2% and 77.4% total category value, respectively.

Most students enrolled in CHE 101 winter term are in their second term of their college career. Thus, study skills should be more developed. Organizational questions build upon the basic knowledge from terminology and methods and thus are expected to be on average lower than either of those categories. To help increase performance in the organization category, more organizational questions were administered for extra practice and the performance improved from 0.736 to 0.774, which exceeds the minimum acceptable value of 0.75.

Detailed results of this assessment are available in the Natural Sciences Assessment notebook as well as copies of the additional homework assigned to the students.

Appendix A: Science General Education Curriculum Map

This is a list of courses that are considered part of the General Science Education program at Oregon Institute of Technology

100 Level			200 Level	
FALL	CHE 101	Elementary CHE	CHE 201/CHE 221	General CHE
	BIO 101	General BIO	BIO 207	Medical terminology
	BIO 111	Intro Env. Science	BIO 211	Principles of BIO
	GEOG 115	Climatology	BIO 231	Human A&P I
			PHYS 201	General PHYS
			PHYS 221	General PHYS w/calc
			PHYS 223	General PHYS w/calc
WINTER	CHE101	Elementary CHE	CHE 202/222	General CHE
	CHE 102	Elementary CHE	BIO 212	Principles of BIO
	BIO 102	General BIO	BIO 232	Human A&P II
	BIO 105	Microbiology	PHYS 202	General PHYS
	GEOG 105	Geomorphology	PHYS 221	General PHYS w/calc
			PHYS 222	General PHYS w/calc
SPRING	CHE 101	Elementary CHE	CHE 223	General CHE
	CHE 103	Elementary CHE	CHE 231	Streamwater CHE
	BIO 103	General BIO	CHE 232	Streamwater Sampling
			BIO 213	Principles of BIO
			BIO 216	Intro to Vet. Medicine
			BIO 233	Human A&P III
		PHYS 203	General PHYS	
		PHYS 222	General PHYS w/calc	
		PHYS 223	General PHYS w/calc	