

GEAR ASSESSMENT DOCUMENTS

State University of New York College at Fredonia

2011

**Conducted by the
College Core Curriculum Assessment Sub-Committees
(General Education Assessment Sub-Committees)**

**for
The Assessment Committee
SUNY Fredonia**

Natural Science General Education Category

Assessment Results

Overview:

Graded student responses were obtained from exam questions and other exercises, as contributed by instructors of Natural Sciences CCC courses during the Spring 2011 semester.

The CCC Natural Sciences teaching faculty members were asked for assessments of the first two Learning Outcomes (LO) and to optionally provide assessment data for two additional (#3 & 4) Learning Outcomes.

Student Learning Outcome #1

- Students are expected to understand the methods scientists use to explore natural phenomena, including observation, hypothesis development, measurement and data collections, experimentation, evaluation of evidence and employment of mathematical analysis

Student Learning Outcome #2

- Application of scientific data, concepts and models in one of the natural sciences

Two additional, but optional learning objectives that apply generally to CCC courses are:

Critical Thinking Learning Outcome #3

- Students should be able to identify, analyze and evaluate arguments as they occur in their own or other's work. Students should be able to develop well-reasoned arguments

Information management Learning Outcome #4

- Students should be able to perform the basic operations of personal computer use,
- Students should be able to understand and use basic research techniques,
- Students should be able to locate, evaluate, and synthesize information from a variety of sources.

Fourteen faculty from Biology, Chemistry, Computer Science, Geosciences, and Physics representing 21 Natural Sciences CCC sections (Appendix I) were emailed frequently to provide them with the request to assess their courses, provide learning objectives, and to remind the instructors to return data in a timely manner.

Grading Methodology:

The subcommittee agreed to evaluate the student responses according to four achievement levels (exceeding, meeting, approaching, and not meeting expectations). These are the same levels used in the previous assessments of the Natural Sciences CCC courses (Fall 2003 and 2007/8). A comparison between the 2007/8 and the current data can be made for Learning Outcomes 1 and 2, however, Learning Outcomes 3 and 4 cannot be compared with the 2007/8 assessment because they were not previously assessed.

The four-level scale works well for the short- and extended-essay questions, which are often used as assessment tools, but less well for multiple choice questions. Assessment using multiple choice must be completed carefully. To assess using a single question would provide only two possible results (either the student's answer is correct, or it is not). The committee encouraged faculty using multiple choice questions for the assessment to create a set containing a minimum of four assessment questions for a particular learning objective. A student answering all four questions correctly would be considered to have exceeded the standard; three correct answers would meet the standard; two correct answers would

approach the standard and one or no correct answers would fail to meet the standard. Not all instructors used this model, providing assessment on as little as a single question.

The outcomes (both raw totals and percentages) are summarized on the accompanying spreadsheet.

Comments:

Faculty participation in assessment. Eleven faculty, representing 15 sections of classes supplied data for the first Learning Outcome. Ten faculty, representing 13 sections of classes supplied data for the second and third Learning Outcomes and three computer science faculty, representing 4 sections of classes submitted data for the fourth Learning Outcome. Three faculty, representing 5 sections (*Chem* 115, 53 students; *Geo* 142, 98 students; *Geo* 145, 97 students; *Geo* 160, 100 students and *Geo* 165, 60 students or a total of 408 students) did not supply any assessment data.

Total assessment has increased significantly. We received a total of 1277 assessments for Question #1, 1223 for #2, 1151 for Learning Outcome #3 and 115 for Learning Outcome #4. Hence a total of 3,766 responses were tabulated (see attached table, below). This represents a significant increase in assessment data compared to the 2007/8 assessment of the Natural Sciences courses when 180 assessments were received for Learning objective #1, 461 for #2 and in that previous report, no assessment was made of Learning objectives #3 and 4. This represents a seven-fold increase in the assessment of the first Learning Outcome and over two and a half times as many assessments for the second Learning Outcome. For the first time we have data on Learning Outcomes 3 and 4.

Learning Outcome #1 (Methods used by Scientists)

It is encouraging that 80.8% of the student responses *exceed or meet* the standard for understanding the basic methods that scientists use and only 7.7% of the students *fail* to understand those methods. It is important to note, however this encompasses a considerable range of responses (from 62-100%) meeting or exceeding the standard across all courses providing data for this Learning Outcome. The percentage of students failing to meet this standard also varied considerably from course to course, ranging from 0-27%.

In the 2007/8 assessment a disappointing 20.6% of the students failed to meet the standard for the first learning objective. This former analysis contained an even larger variation across all courses with as many as 50% of the students failing to meet the standard in one course. The authors of the previous report speculated that an increased number of very weak (or less diligent) students could have been responsible for the poor performance. In the current assessment students performed best on the first Learning Outcome and less well on the other Learning Outcomes.

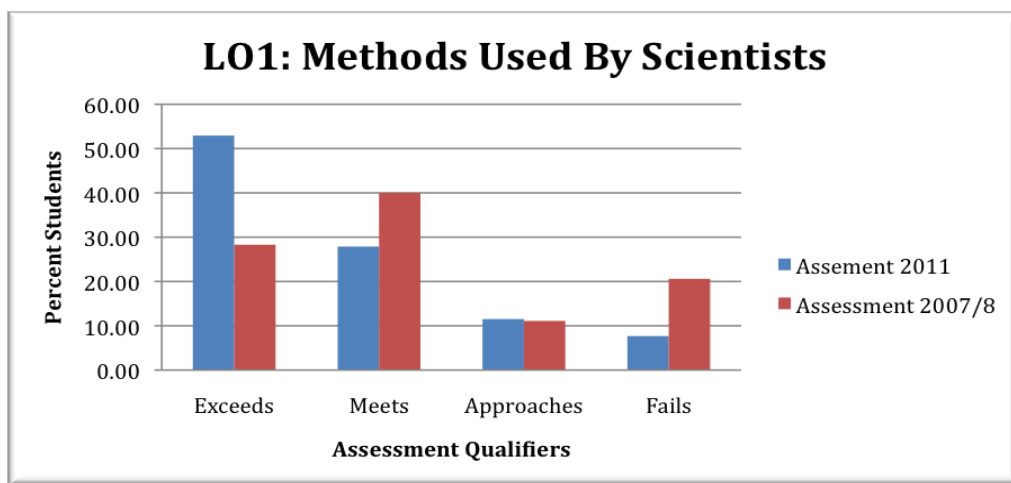


Figure 1: Aggregate Learning Outcome1 Results

Learning Outcome #2 (Application of Data)

Slightly less than 70% of the responses for Learning Outcome #2 *met or exceeded* the standard and 17% of the responses *failed* to meet the standard. Once again the responses ranged from a low of 34% to a high of 98.3% meeting or exceeding the standard when compared across courses. A larger percentage of the student responses (17 %) *failed* to meet this standard, compared to Learning Outcome #1.

The current data is comparable to the data obtained in the 2007/8 assessment, when 19.1% of the students *failed* to meet the standard and 72.3% of the students *met or exceeded* the standard. In the current assessment slightly lower percentages met/exceeded and failed to meet the standard.

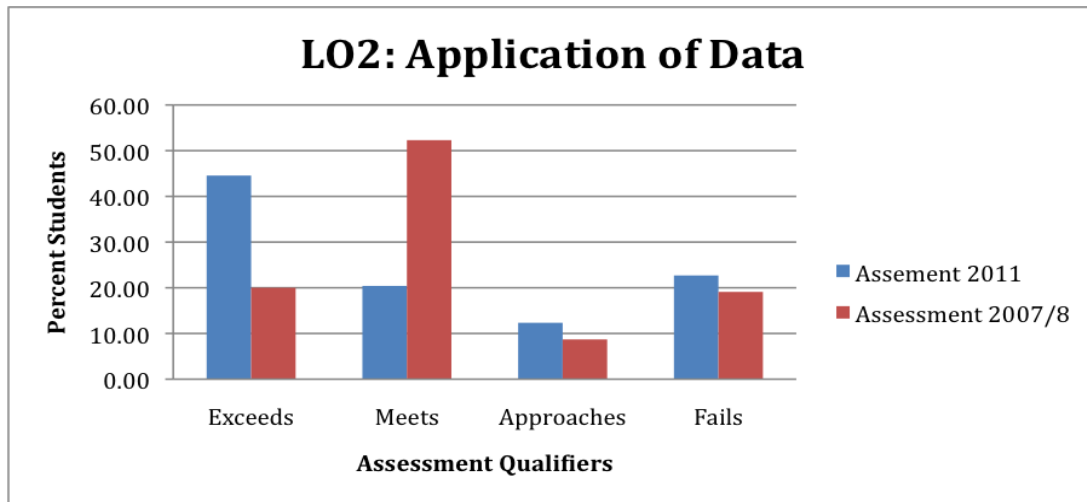


Figure 2: Aggregate Learning Outcome2 Results

Learning Outcome #3 (Critical Thinking)

This may be the first time this learning outcome has been assessed and/or reported for the Natural Sciences courses. The assessment data obtained indicates that 70.1% of the students *exceeded or met* the standard and 13.4% of the students *failed* to meet the standard. Once again there is considerable variation from course to course and assessment to assessment. The range of students *exceeding or meeting* the standard was from a low of 43.9% to a high of 100%.

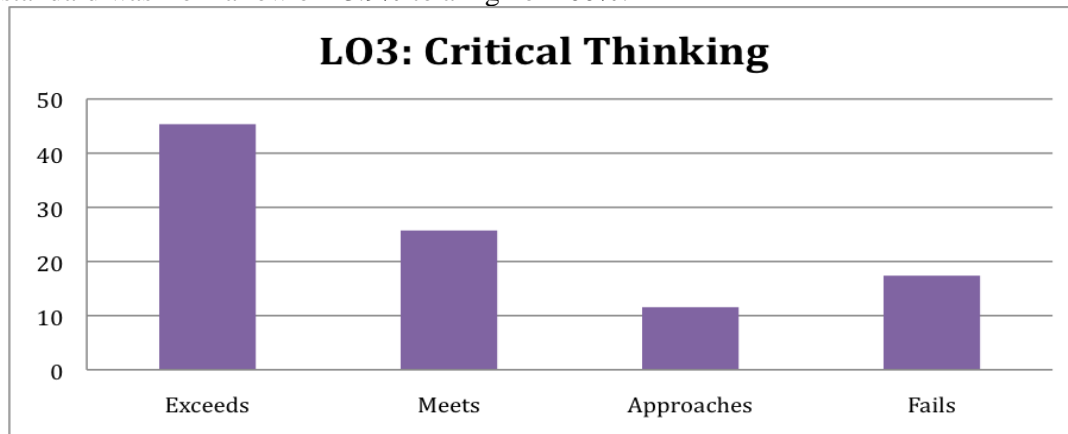


Figure 3: Aggregate Learning Outcome3 Results

Learning Outcome #4 (Information Management)

It is appropriate that the Computer Sciences department assessed the students for the Learning Outcome on information management. 68.8% of the students *met or exceeded* the standard and once again about 20% of the students *failed* to meet the standard.

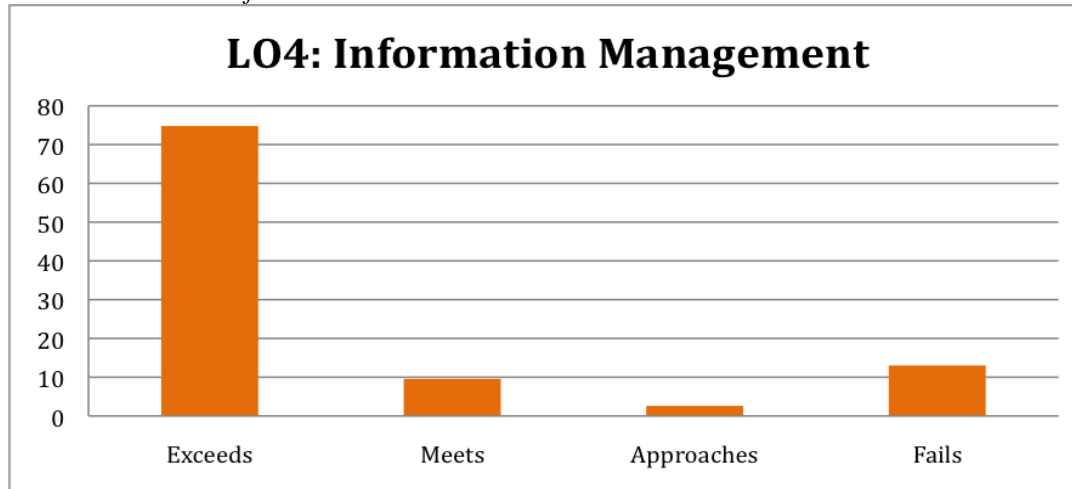


Figure 4: Aggregate Learning Outcome 4 Results

Discussion and Comments

- The Natural Sciences Assessment committee would like to thank all those who took the time to complete the assessment for their course(s) and supply data for this report.
- Compared to the last assessment of the CCC Natural Science courses (2007/8) there has been a dramatic increase in the amount of data accumulated. This is likely attributed to the persistent email requests for data from the Chair of the committee (see below). Compared to the previous assessment, there is a seven-fold increase in the number of responses for Student Learning Outcome #1 (1277 responses in 2011 compared to 180 responses in 2007/8) and a 2.6 fold increase in the number of responses for Student Learning Outcome #2 (1223 responses in 2011 compared to the 461 responses in the 2007/8 report). Even though there was an increased response rate some instructors submitted very little data (one time) where other instructors provided assessment data for each of their exams (up to four exams in the semester).
- While it is difficult to draw specific conclusions from the data, we conclude that in all learning outcomes a significant majority of students Meet or Exceed the standards for their course.
- It is a concern that in some courses virtually all students Exceed the standard (94%+ in some cases) and in other cases very few (less than 15%) of the students exceed the standard. This leaves questions about differences in the rigor of courses and the ability to draw significant conclusions.
- It is important to note that this is the first assessment of the Natural Sciences courses that has reported data for Student Learning Outcomes #3 and 4. In both cases the data indicate that for the most part students are able to deal with Critical Thinking and Technology related issues.

Recommendations

1. This committee was formed in December of 2010 and given its charge of assessing the Natural Sciences CCC courses. Each instructor was sent a series of emails informing them of the Learning Objectives, samples of Data Tables and reminding them to submit the data for their course(s). In all about ten emails were sent to each instructor. It is likely that the repeated reminders resulted in the increased data compiled in this report (compared to 2007/8). Even though the increase in data was satisfying, the responses occurred sporadically during the semester and a significant proportion of the responses were submitted only after final grades had been submitted. Still others did not submit any data (see Appendix 1). **We recommend the development of a more formal mechanism involving coordination between the Dean's office and the CCC committee to inform the instructors and remind them to assess their courses and submit data on a regular basis.**
2. **We recommend that the CCC committee work with each instructor to inform him or her about the Learning Outcomes expected for their course.** It came as a revelation to even some of the assessment committee members that there were defined Learning Objectives to be assessed. It is therefore important to stress the expectations for assessment so that instructors can be encouraged to incorporate the learning objectives as they revise their courses.
3. One of the requirements was for each instructor to also submit a representative sample of the student responses representing 20% of each class. We question the usefulness of this sampling because little if any use was made of the submitted materials. **We would recommend that the submission of 20% of the responses be abandoned and in its place each instructor be asked to interpret their data in an attempt to close the loop on assessment. Each instructor might be asked to reflect on what they might do differently to improve learning with respect to the various learning objectives.** As with previous committee recommendations we are aware of the arguments related to consistency, honesty and defensiveness, etc., however we agree with previous committees that a "committee-as-graders" approach not be pursued; rather grading is a task best performed by the individual instructors.

Assessment Data Chart

(Exceeding, Meeting, Approaching, Not meeting expectations)

DATA	CCC Part 7	Spring 2011 Raw Data					%				
Learning Outcome	Course	Exceed	Meet	Appr	Not	Total students	Exceed	Meet	Appr	Not	Total %*
1	BIOL 110	95	24	9	4	132	72.0	18.2	6.8	3.0	100
1	BIOL 111	23	21	18	4	66	34.8	31.8	27.3	6.1	100
1	BIOL 111	86	16	23	16	141	61.0	11.3	16.3	11.3	100
1	BIOL 111	55	0	2	0	57	96.5	0	3.5	0	100
1	BIOL 115	55	2	1	0	58	94.8	3.4	1.7	0	100
1	BIOL 115	8	48	0	2	58	13.8	82.8	0	3.4	100
1	CHEM 113	21	12	6	6	45	46.7	26.7	13.3	13.3	100
1	CSIT 120	5	30	3	2	40	12.5	75.0	7.5	5.0	100
1	CSIT 120	40	0	0	0	40	100	0	0	0	100
1	GEO 148	35	28	12	17	92	38.0	30.4	13.0	18.5	100
1	GEO 148	30	34	23	5	92	32.6	37.0	25.0	5.4	100
1	GEO 148	36	7	0	2	57	80.0	15.6	0.0	4.4	100
1	GEO 165	3	47	5	2	57	5.3	82.5	8.8	3.5	100
1	GEO 165	38	10	0	9	57	66.7	17.5	0	15.8	100
1	GEO 165	43	5	4	5	57	75.4	8.8	7.0	8.8	100
1	GEO 175	21	8	5	3	37	56.8	21.6	13.5	8.1	100
1	GEO 175	21	7	8	1	37	56.8	18.9	21.6	2.7	100
1	GEO 175	12	11	8	6	37	32.4	29.7	21.6	16.2	100
1	GEO 175	10	13	10	4	37	27.0	35.1	27.0	10.8	100
1	GEO 175	25	1	1	10	37	67.6	2.7	2.7	27.0	100
1	PHYS 230	14	32	9	0	55	25.5	58.2	16.4	0	100
1	Subtotal	676	356	147	98	1277	52.9	27.9	11.5	7.7	100
2	BIOL 111	56	0	0	9	65	86.2	0.0	0.0	13.8	100
2	BIOL 111	34	0	23	0	57	59.6	0.0	40.4	0.0	100
2	BIOL 111	6	20	15	17	58	10.3	34.5	25.9	29.3	100
2	BIOL 111	7	20	18	13	58	12.1	34.5	31.0	22.4	100
2	BIOL 111	49	5	9	8	71	69.0	7.0	12.7	11.3	100
2	BIOL 111	19	25	10	12	66	28.8	37.7	15.2	18.2	100
2	BIOL 111	20	0	0	39	59	33.9	0.0	0.0	66.1	100
2	BIOL 111	12	11	8	28	59	20.3	18.6	13.6	47.5	100
2	BIOL 115	55	2	1	0	39	94.8	3.4	1.7	0.0	100
2	CHEM 113	21	12	6	6	45	46.7	26.7	13.3	13.3	100
2	CSIT 120	50	1	2	17	70	71.4	1.4	2.9	24.3	100
2	GEO 148	35	28	12	17	92	38.0	30.4	13.0	18.5	100
2	GEO 148	30	34	23	5	92	32.6	37.0	25.0	5.4	100
2	GEO 148	36	7	0	2	45	80.0	15.6	0.0	4.4	100
2	GEO 165	23	24	5	5	57	40.4	42.1	8.8	8.8	100
2	GEO 165	38	14	5	0	57	66.7	24.6	8.8	0.0	100
2	GEO 165	10	29	0	18	57	17.5	50.9	0.0	31.6	100
2	GEO 175	21	8	5	3	37	56.8	21.6	13.5	8.1	100

2	GEO 175	21	7	8	1	37	56.8	18.9	21.6	2.7	100
2	GEO 175	12	11	8	6	37	32.4	29.7	21.6	16.2	100
2	PHYS 230	30	10	4	2	46	65.2	21.7	8.7	4.3	100
2	Subtotal	585	268	162	298	1223	47.8	21.9	13.2	17.0	100
3	BIO 111	26	0	0	39	65	40.0	0.0	0.0	60.0	100
3	BIO 111	67	35	19	20	141	47.5	24.8	13.5	14.2	100
3	BIO 111	50	38	22	27	137	36.6	27.7	16.1	19.7	100
3	BIO 111	12	28	0	18	58	20.7	48.3	0.0	31.0	100
3	BIO 111	19	27	5	7	58	32.8	46.6	8.6	12.1	100
3	BIO 111	25	21	10	10	66	37.9	31.8	15.2	15.2	100
3	BIO 111	37	23	6	10	76	48.7	30.3	7.9	13.2	100
3	BIO 115	45	5	6	2	58	77.6	8.6	10.3	3.4	100
3	CHEM 113	15	12	8	10	45	33.3	26.7	17.8	22.2	100
3	CSIT 120	34	6	0	0	40	85.0	15.0	0.0	0.0	100
3	GEO 148	35	28	12	17	92	38.0	30.4	13.0	18.5	100
3	GEO 148	30	34	23	5	92	32.6	37.0	25.0	5.4	100
3	GEO 148	36	7	0	2	45	80.0	15.6	0.0	4.4	100
3	GEO 165	10	15	14	18	57	17.5	26.3	24.6	31.6	100
3	GEO 175	24	7	3	3	37	64.9	18.9	8.1	8.1	100
3	GEO 175	25	1	1	10	37	67.6	2.7	2.7	27.0	100
3	PHYS 230	32	9	4	2	47	68.1	19.1	8.5	4.3	100
3	Subtotal	522	296	133	200	1151	45.4	25.7	11.6	13.4	100
4	CSIT 120	28	1	1	10	40	70	2.5	2.5	25	100
4	CSIT 120	25	8	2	0	35	71.3	22.9	5.7	0	100
4	CSIT 120	33	2	0	5	40	82.5	5	0	12.5	100
4	Subtotal	86	11	3	15	115	21.0	47.8	10.5	20.7	100

Appendix 1 Courses and Instructors asked to participate in the Assessment

Course	Number of students	Instructor	Assessment Submitted? data
Biology 110	70	Doug Dolan	Yes
Biology 110	70	Doug Dolan	Yes
Biology 111	75	Bruce Tomlinson	Yes
Biology 111	75	Bruce Tomlinson	Yes
Biology 111	70	Wayne Yunghans	Yes
Biology 115	42	Michelle Kuhns	Yes
Chem 113	50	Sherri Mason	Yes
Chem 115	60	Holly Lawson	No
CSIT 120	40	Greg Cole	Yes
CSIT 120	40	David Conroe	Yes
CSIT 120	40	David Conroe	Yes
CSIT 120	25	Michael Szocki	Yes
Geo 142	94	Gary Lash	No
Geo 145	78	Greyford Hunter	No
Geo 148	74	Michael Wilson	Yes
Geo 160	94	Gary Lash	No
Geo 165	60	Greyford Hunter	No
Geo 165	60	Kim Weborg-Benson	Yes
Geo 175	40	Michael Wilson	Yes
Physics 230	28	Erica Snow	yes