Student Learning in Natural Science with a Laboratory Experience Courses
Self-Study Report
June 2014

Updated from report in June 2013

Respectfully Submitted June 13, 2014
By Jennifer Schroeder, Biology

I. Executive Summary

The departments of Biology, Chemistry, and Physics have developed the following learning goals for students taking a course that satisfies the MPSL Natural Science with Lab non-sequential requirement:

1) Develop an understanding of how to use logic and the scientific method to analyze the natural world and solve problems.

2) Learn about issues in science that are important both personally and globally.

3) Utilize technology in laboratory and field environments in order to connect theories and descriptions found in lectures and textbooks with real-world phenomena.

A student who is able to reach these goals successfully will also be satisfying the core goals expressed in the mission statement of Millikin University. The first and third goals, in particular, will help a student achieve *professional success*, as being able to utilize the scientific method as a mode of inquiry will be valuable in any career. Meeting all three goals will also contribute to a Millikin graduate being a *democratic citizen in a global environment*. Dealing with problems in a global society requires integration of knowledge and strong problem solving skills. The second and third goals are particularly focused on *preparing students for a personal life of meaning and value*. Issues in science affect everyone daily, and understanding what these issues are will better prepare students to understand how they in particular are affected.

The courses that students take to satisfy these learning goals come from all three departments and are taught by a majority of the faculty in each department. Prior to 2011, the evaluations were limited to one course per department. From 2011-2013, the assessments included several courses per department, and were assessed based upon syllabi, assignments and rubrics, and student artifacts. The courses assessed included all that could be included for the Natural Science with a Lab non-sequential requirement, including courses in the majors that might previously have been excluded from the assessment.

Based on the rubrics created for assessing the learning goals and assessment over the last 3 years, our status on all three learning goals was a "**green light**" (at an acceptable level). However, after a call for a new assessor and a review of the learning goals by the division following the 2012-2013 AY, no new assessor was chosen, the learning goals were not reviewed, and no faculty submitted any artifacts, either student or their own. However, there were only minimal changes to the courses and faculty who taught in the MPSL for AY 2013-2014, thus the assessor can only assume that the material remains at a "**green light**" status. However, per the recommendation of faculty from Chemistry in past academic years and the current assessor, at the start of the 2014-2015 academic year the goals should be reviewed and updated and a new, full assessment be completed for the 2014-2015 AY.

II. Goals

In the opinion of the faculty in the Departments of Biology, Chemistry, and Physics, upon completion of a Natural Science with a Laboratory Experience course at Millikin University, a student will be able to:

1) Use logic and the scientific method to analyze the natural world and solve problems.

2) Analyze issues in science which are important both personally and globally.

3) Connect theories and descriptions found in lectures and textbooks with real-world phenomena utilizing appropriate technology in laboratory and field environments.

A student who is able to reach these goals successfully will also be satisfying the core goals expressed in the mission statement of Millikin University. The first and third goals, in particular, will help a student achieve *professional success*, as being able to utilize the scientific method as a mode of inquiry will be valuable in any career. Meeting all three goals will also contribute to a Millikin graduate being a *democratic citizen in a global environment*. Dealing with problems in a global society requires integration of knowledge and strong problem solving skills. Performing informative and interesting experiments is one way scientists interact with the world; therefore, understanding issues in science and the process scientists go through is invaluable in understanding the impact of science-related issues on their lives. The second and third goals are particularly focused on *preparing students for a personal life of meaning and value*. Issues in science affect everyone daily, and understanding what these issues are will better prepare students to understand how they in particular are affected. Also, being able to connect the theory in texts to the practical applications of science in their lives will help the students be life-long learners and continue to integrate future developments in science into their understanding of the world.

These goals will be reviewed in the 2014-2015 academic year.

III. Snapshot

The departments of Biology, Chemistry, and Physics at Millikin University were staffed in 2013-14 by 15 full-time faculty, 6 adjunct faculty or instructors, and 1.5 academic staff support personnel. One of the biology faculty (Cynthia Handler) has a half-time position in the department; the remaining half of her load is as the pre-professional advisor. Two of the instructors (Roslyn O'Conner and Katherine Fritts) have part of their load directed to lab support (lab set-ups, chemical inventory, ordering supplies, etc). All three departments are housed in the Leighty-Tabor Science Center (LTSC), which opened in 2002, and provides an excellent teaching and research facility. Full-time faculty generally teach a variety of courses, including service courses aimed at a general audience (non-majors), service courses aimed at a specific audience (for example, courses for Nursing or Exercise Science majors), and courses for science majors. Adjuncts typically help with laboratory instruction or non-majors courses. The smallest science courses (upper-level courses) may have approximately 8 students while the largest may serve 60 or more students. Some of these larger courses include Anatomy and Physiology I and II, Essentials of Organic and Biochemistry, and Introductory Astronomy courses. Lab courses are usually capped at a maximum of 20-24 students. The courses analyzed for this assessment are those that either fulfill the Natural Science with a Laboratory Experience requirement for non-science majors, or are the first Millikin-based science course for science majors.

Courses taught Fall 2013 (F) or Spring 2014 (S) that met the MPSL Natural Science with a Laboratory Experience requirement are:

- BI 102, Biochemistry of Food – Dr. Samuel Galewsky (F,S)
- BI 102, Biology of Infectious Disease – Dr. Jeff Hughes (F,S)
- BI 102, Biology of Birds – Dr. David Horn (F,S)
- BI 102, Biology of Mammals – Dr. Gregg Marcello (F)
- BI 102, Current Issues in Biology – Prof. Roslyn O'Conner (S)
- BI 102, Human Biology – Dr. Cynthia Handler (S)
- BI 105/155, Ecology & Evolution – Dr. Judy Parrish, Dr. Marianne Robertson, Dr. Travis Wilcoxen (F)
- BI 108/158 Diversity of Life – Dr. Judy Parrish, Dr. Sangeetha Srinivasan (S)
- BI 130, Environmental Biology – Prof. Roslyn O'Conner (F)
- BI 204, Essentials of A&P – Dr. Cynthia Handler (F), Dr. Jennifer Schroeder (S)
- BI 206, A&P I – Dr. Gregg Marcello (F,S)
- BI 207, A&P II – Dr. Travis Wilcoxen (F,S), Dr. Jeff Hughes (S)
- BI 230, Principles of Microbiology – Dr. Sangeetha Srinivasan (F), Dr. Jeff Hughes (S)
- BI 280, Ecological Journey: South Africa – Dr. Judy Parrish (F)
- CH 121/151, General Chemistry – Prof. Elizabeth Stensrud (F), Dr. Ed Acheson (F), Prof. Lynette Nehmer (F), Prof. Katherine Fritts (F,S), Dr. Randall Kok (F), Prof. Marie Gregory (F), Dr. Paris Barnes (F), Dr. Timothy Guasco (F), Prof. Patricia Higgins (S)
- CH 131, Accelerated General Chemistry – Dr. Paris Barnes (F)
- IN 204, Biology of Spiders – Dr. Marianne Robertson (S)
- PY 100/104 The Planets – Dr. Casey Watson (S)
- PY 101/105 Stars and Galaxies – Dr. Casey Watson (F)
- PY 111, College Physics I – Dr. Eric Martell (F)
- PY 112, College Physics II – Dr. Eric Martell (S)
- PY 151, University Physics I – Dr. Eric Martell (F)
- PY 152, University Physics II – Dr. Eric Martell (S)
- PY 171, Physics Lab I – Dr. Eric Martell (F)
- PY 172, Physics Lab II – Dr. Eric Martell (S)

IV. Learning Story

There are three main groups of students who take natural science courses at Millikin: 1) Natural Science majors, who take a dozen or more science courses; 2) students majoring in fields like Nursing or Exercise Science, who do not take quite as many science courses but still take a sizable number; and 3) students who take one (or sometimes two) science courses to fulfill graduation requirements. The first group of students generally has a different set of learning goals – specifically, the goals for learning within the major. However, while some of the above courses (BI 102, PY 101) have students from the third group as their primary audience, other courses (CH 121, PY 151, for example) have very diverse audiences. These latter courses must be carefully constructed such that majors get a strong introduction to the field at the same time non-majors or general education students satisfy the learning goals from section I.

As you can see from compiled data from 2011-2013, the majors for students taking these courses is quite diverse.

Major	2011	2012	2013
Accounting	21	12	12
Applied Mathematics	4	9	4
Art	2	2	4
Art Education	1	1	0
Art Therapy	7	2	2
Athletic Training	26	27	47
Biology	123	173	253
Biology - Secondary Teaching	10	4	9
Business Management	6	6	9
Business Undecided	12	9	2
Chemistry - Secondary Teaching	3	39	0
Chemistry	27	0	75
Commercial Art	1	13	0
Commercial Music	18	49	7
Communication	25	15	43
Early Childhood Education	19	25	16
Elementary Ed	25	1	29
English - Literature	1	4	1
English - Secondary Teaching	6	11	5
English - Writing	7	6	4
Entrepreneurship	2	36	1
Exploratory Studies	23	6	39
Finance	3	28	7
Fitness and Sport	57	1	6
Graphic Design	1	20	2
Health/Fitness/Recreation	N/A	N/A	31
History	5	8	1
Human Services	23	26	33
Information Systems	3	1	11

Major	2011	2012	2013
Interdepartmental	6	2	0
International Business	3	1	0
International Studies	2	0	2
Marketing	6	9	7
Math - Secondary Teaching	5	2	3
Math w/ Actuarial Science	3	3	0
Music	4	13	2
Music Business	8	14	10
Music Ed Instrumental	2	6	3
Music Ed Vocal	11	12	10
Music Performance Instrumental	3	6	5
Music Performance Vocal	11	2	4
Musical Theatre	11	4	6
Non-Degree	2	0	6
Nursing	49	81	182
Philosophy	4	5	5
Phys Ed (K-12)	27	25	13
Physics	10	16	32
Political Science	0	4	6
Psychology	20	35	42
Soc Science Secondary Teach	0	3	13
Sociology	13	16	5
Spanish	3	1	0
Sport Management	1	22	22
Stage Management	1	0	0
Studio Art	6	9	5
Theatre	29	23	14
SUM	**701**	**848**	**1050**

Because of the variety of courses students can take to fulfill this requirement, there is no single story which best describes the experiences a student gets in a first Natural Science with a Laboratory Experience course. The ways in which a student can achieve the stated learning goals are as varied as the different courses they can choose to take. Students in all courses are exposed to time-honored and trusted teaching methods as well as research-based pedagogical techniques that are on the cutting edge of teaching and learning in the field. Lectures and labs are well integrated and emphasize critical thinking, application, and problem solving skills.

V. Assessment Methods

Prior to 2011, one faculty member was selected from each of three departments – Biology, Chemistry, and Physics – to represent the diversity of courses offered which meet this requirement, and that faculty assess his or her own course. These assessments were then compiled into the overall assessment.

However, we realize that this is a strong underrepresentation of the breadth of courses which are offered. As listed in the snapshot, there are twenty-three discrete course titles which meet the requirement, and many of these are offered multiple times throughout the year. Thus, assessing only three courses was insufficient. We also recognize that although the means of assessment is meant to be rigorous and impartial, it is difficult to be objective when analyzing the learning goals and results from one's own course. These courses are designed in part with the learning goals in mind, and thus should ideally meet all of the goals without fail. However, this may not in fact be the case and meeting the requirements of the learning goals may not be as apparent as the faculty who designed the course might assume.

To ensure that the assessment is in-depth, a larger subset of courses was assessed for three academic years, 2011-2013. An analysis of the number of courses and number of faculty contributing artifacts to the assessment is listed below.

2011	Courses Analyzed		Faculty Participating	
	#	%	#	%
Biology	7	33.3	5	45.5
Chemistry	2	50.0	3	60.0
Physics	4	66.7	2	100.0
Overall	**13**	**41.9**	**10**	**55.6**

2012	Courses Analyzed		Faculty Participating	
	#	%	#	%
Biology	14	53.8	6	50.0
Chemistry	5	62.5	3	50.0
Physics	2	22.2	1	50.0
Overall	**21**	**48.8**	**10**	**50.0**

2013	Courses Analyzed		Faculty Participating	
	#	%	#	%
Biology	11	35.5	6	54.5
Chemistry	5	41.7	4	44.4
Physics	4	44.4	2	100.0
Overall	**20**	**38.5**	**12**	**54.5**

Since 2011, when more faculty were asked to submit artifacts for assessment, several faculty have participated. Others have not submitted within the last three years despite their teaching of courses for the MPSL. Thus, we must adjust our assessment to be more realistic based upon actual contributions instead of desired contributions, and recognize that 100% participation is not possible. We do hope as the assessment moves forward, however, that we can achieve 100% participation from Physics, and at least 60-70% participation from Biology and Chemistry.

Based upon the progress, the assessments for participation were scored as follows:

	2011	2012	2013
Biology	RED	YELLOW	GREEN
Chemistry	YELLOW	GREEN	YELLOW
Physics	GREEN	RED	GREEN

In the future, it would be ideal to assess at least half of the faculty and half of the courses offered by each department.

One will note that values are missing for the 2013-2014 AY. This is due to miscommunication within the division. At the end of the 2013 assessment, Dr. Jennifer Schultz-Norton (now Schroeder) resigned the position as assessor and asked for the division to review the assessments fully and determine whether the learning goals should be updated. These learning goals have been in place since before her start at Millikin in 2008, and thus a review every 5 to 10 years is not unreasonable. In addition, Chemistry had requested that a writing component, which is present in every science course, be added to the assessment. However, without a specific learning goal, this would be difficult to assess. Unfortunately, no new assessor was chosen, learning goals were not reviewed, and no artifacts were submitted by any faculty for either Fall or Spring semesters. *Thus, an assessment of the courses is not possible for the 2013-2014 AY and any assessment submitted must make assumptions that there were little to no changes in the last academic year.*

Rubrics for Faculty Directions for Artifact Assessment

The grading rubrics used to assess each learning goal from faculty artifacts have three categories: Excellent, Adequate, and Unsatisfactory. In evaluating faculty artifacts for each learning goal, rubric scores of 1, 3, or 5 were assigned to each category.

- For totals between 10.0 and 15.0, a "green light" (an acceptable level or clearly heading in the right direction and not requiring any immediate change in course of action) was assigned for that learning goal.
- For totals between 6.0 and 9.9, a "yellow light" (not an acceptable level; either improving, but not as quickly as desired or declining slightly. Strategies and approaches should be reviewed and appropriate adjustments taken to reach an acceptable level or desired rate of improvement) was assigned for that learning goal.
- For totals below 6.0, a "red light" (our current status or direction of change is unacceptable. Immediate, high priority actions should be taken to address this area) was assigned for that learning goal.

The other branch of this assessment examined whether the students met the learning goals through these assignments. For the artifacts, a random sampling of the submitted work was assessed (with a minimum of two artifacts per course). The grading rubrics used to assess each of these learning goals were assigned the rubric scores as defined above for "green", "yellow", and "red" lights.

VI. Assessment Data

A. SIR Data Comparison

SIR data were collected in the 2011-2013 assessments but were not collected for the 2014 assessment.

B. Syllabus Audit Data

No syllabi were collected for the 2013-2014 AY.

C. Artifact Collection: Faculty rubric and student artifact analysis

Several years ago, the Natural Science with a Lab Experience courses were assessed by selecting three faculty volunteers and asking them to assess their own courses. However, given the extent of assessment being done for other MPSL requirements, this seemed inadequate and may be skewed due to inherent bias when assessing one's own course. Beginning with the 2010-2011 assessment, all faculty that taught courses that could be used to fill the MPSL requirement (such as those geared towards freshman-level or first-course-in-the-major) were asked to submit artifacts. This led to a very lengthy assessment process that may have not fully reflected how we address our learning goals. Several faculty provided multiple student artifacts for each course; others did not submit artifacts at all. For the 2012-2013 assessment, the artifact request was altered to include both a faculty assignment plus three student artifacts for each of the three learning goals. This would lead to up to 12 artifacts per course. With 54 syllabi assessed in 2013, this was still a daunting task; however the assessor realized that 1) only a subset of faculty will participate, 2) some assignments may address more than one learning goal, and 3) some courses may not address all learning goals as they may divide them between lab and lecture sections of a course. The assessor on all of these artifacts was Dr. Jennifer Schultz-Norton (now Schroeder).

As there were no artifacts submitted for 2014, a compilation of past data is being reviewed to identify whether there are trends indicating success, or whether there are points that must be further reviewed. After adding up and averaging the scores for the individual departments, the rubric scores on the faculty artifacts are the following:

Average of Rubric Scores (2011)			
	Goal 1	**Goal 2**	**Goal 3**
Biology	11.9	9.0	13.4
Chemistry	12.5	10.0	14.5
Physics	13.0	10.7	N/A
Overall	12.4	9.5	13.7

Average of Rubric Scores (2013)			
	Goal 1	**Goal 2**	**Goal 3**
Biology	13.7	12.6	13.8
Chemistry	12.0	10.0	13.0
Physics	13.0	11.0	N/A
Overall	13.1	11.9	13.6

Average of Rubric Scores (2012)			
	Goal 1	**Goal 2**	**Goal 3**
Biology	10.3	9.3	10.9
Chemistry	11.6	10.8	12.4
Physics	14.5	N/A	N/A
Overall	10.9	9.5	11.3

Total Number of Artifacts Provided (2011)			
	Goal 1	**Goal 2**	**Goal 3**
Biology	6	9	7
Chemistry	3	1	2
Physics	4	3	0
Overall	13	13	9

Total Number of Artifacts Provided (2012)			
	Goal 1	Goal 2	Goal 3
Biology	36	36	33
Chemistry	21	6	13
Physics	2	0	0
Overall	59	42	46

Total Number of Artifacts Provided (2013)			
	Goal 1	Goal 2	Goal 3
Biology	19	16	20
Chemistry	10	6	5
Physics	1	1	0
Overall	30	23	25

After adding up and averaging the scores for the individual departments, the rubric scores on student artifacts are the following:

Average of Rubric Scores (2011)			
	Goal 1	Goal 2	Goal 3
Biology	8.5	10.8	9.0
Chemistry	11.0	N/A	12.5
Physics	N/A	N/A	N/A
Overall	9.3	10.8	10.2

Total Number of Artifacts Provided (2011)			
	Goal 1	Goal 2	Goal 3
Biology	4	20	4
Chemistry	2	0	2
Physics	0	0	0
Overall	6	20	6

Average of Rubric Scores (2012)			
	Goal 1	Goal 2	Goal 3
Biology	10.7	9.4	11.1
Chemistry	7.4	11.0	7.3
Physics	10.4	9.8	10.5
Overall	10.6	9.6	10.9

Total Number of Artifacts Provided (2012)			
	Goal 1	Goal 2	Goal 3
Biology	7	15	8
Chemistry	21	3	21
Physics	7	6	4
Overall	35	24	33

Average of Rubric Scores (2013)			
	Goal 1	Goal 2	Goal 3
Biology	11.7	11.9	12.1
Chemistry	9.0	6.8	11.9
Physics	N/A	N/A	N/A
Overall	11.7	10.3	12.0

Total Number of Artifacts Provided (2013)			
	Goal 1	Goal 2	Goal 3
Biology	26	27	26
Chemistry	13	12	20
Physics	0	0	0
Overall	39	39	46

2011	Courses Analyzed		Faculty Participating	
	#	%	#	%
Biology	3	14.3	2	18.2
Chemistry	1	25.0	1	20.0
Physics	0	0.0	0	0.0
Overall	4	12.9	3	16.7

2012	Courses Analyzed		Faculty Participating	
	#	%	#	%
Biology	7	26.9	4	33.3
Chemistry	3	15.8	3	50.0
Physics	2	22.2	1	50.0
Overall	12	22.2	8	44.4

2013	Courses Analyzed		Faculty Participating	
	#	%	#	%
Biology	10	32.3	6	54.5
Chemistry	5	41.7	4	44.4
Physics	0	0.0	0	0.0
Overall	15	27.8	10	55.6

VII. Analysis

A. Syllabi Audits

Syllabi were not collected nor assessed for the 2013-2014 AY.

Over the past 3 assessments, syllabi were audited under a formal rubric that is very similar to the rubric utilized for the IN 140 assessment. For the 2011 analysis, the rubric was not distributed to faculty in advance, and it was evident that some areas are severely lacking. The rubric was included in the MPSL NSLE assessment that was distributed to all faculty in the natural sciences, with the hope that changes would be made to the syllabi to incorporate the recommended suggestions. Several improvements were noted in 2012 and even more improvements were seen in 2013.

- All faculty have now included full contact information, near the top of their syllabus
- Approximately 90% of the syllabi contain a detailed course description
- All syllabi include a point distribution breakdown for assignments as well as a grading scale
- All syllabi included academic honesty and disability statements using the standard Millikin wording
- All syllabi contain some basic learning goals, with over 60% including the specific MPSL science goals

The addition of the learning goals to the syllabi is a huge improvement from past assessments. However, a majority of the syllabi did not state how those learning goals are being assessed, with only 6 of 54 having a specific assignment mentioned. After reviewing the syllabi, many of the faculty could provide an artifact which they feel assesses each specific learning goal. It would assist the students and the faculty assessing the courses overall if faculty would revise their syllabi to show the students how they are applying the learning goals to the course. This recommendation will be strongly made, and we hope that faculty will continue to make this minor yet important change to their syllabi.

We score the audit assessment as follows for 2013:

Course Identification: course number, course name, faculty, semester	**GREEN**
Faculty contact info: name, office, office hours, office phone, email address	**GREEN**
Course description: Standard description plus faculty written course description/overview	**GREEN**
Standard course learning goals	**GREEN**
MPSL learning goals	**YELLOW**
Instructor's grading policy - scale and weights for assignments & for the semester	**GREEN**
Instructor's attendance policy – penalties	**GREEN**
Academic honesty & integrity statement (standard)	**GREEN**
University disability statement (standard)	**GREEN**
Specification of a written assignment that will serve as Logic and the Scientific Method artifact for assessment purposes	**RED**
Specification of a written assignment that will serve as Scientific Issues artifact for assessment purposes	**RED**
Specification of a written assignment that will serve as Technology in the Lab and Field Environments artifact for assessment purposes	**RED**

B. Artifact Collection: Rubric and directions analysis

No faculty rubrics were submitted for assessment in AY 2013-2014.

Over the past 3 assessments, the number of artifacts collected and assessed were as follows:

Overall 2011			
	Red Light (<6)	**Yellow Light (6-9.9)**	**Green Light (10-15)**
Goal 1	0 (0%)	1 (7%)	13 (93%)
Goal 2	2 (15%)	3 (23%)	8 (62%)
Goal 3	0 (0%)	0 (0%)	9 (100%)

Overall 2012			
	Red Light (<6)	**Yellow Light (6-9.9)**	**Green Light (10-15)**
Goal 1	2 (3%)	21 (36%)	36 (61%)
Goal 2	2 (5%)	21 (50%)	19 (45%)
Goal 3	0 (0%)	10 (22%)	36 (78%)

Overall 2013			
	Red Light (<6)	**Yellow Light (6-9.9)**	**Green Light (10-15)**
Goal 1	0 (0%)	2 (7%)	28 (93%)
Goal 2	0 (0%)	7 (30%)	16 (70%)
Goal 3	0 (0%)	1 (4%)	24 (96%)

Since for many of the submitted artifacts were from the same faculty member, we asked for a limited number of artifacts from each course for 2013. The following is the assessment of the goals in 2013:

> Learning Goal 1 - The data show that **93%** of faculty artifacts effectively monitor the students' ability to "use logic and the scientific method to analyze the natural world and solve problems." However, including those artifacts with a moderate coverage of the goal increases this number to **100%**. Thus, this is rated as GREEN.
>
> Learning Goal 2 - Only **70%** of the faculty artifacts submitted to meet the learning goal excellently expressed how the students would be able to "analyze issues in science which are important both personally and globally." However, since **100%** of the faculty have at least adequate coverage of the goal, this goal is rated as GREEN.
>
> Learning Goal 3 - "Students will connect theories and descriptions found in lectures and textbooks with real-world phenomena utilizing appropriate technology in laboratory and field environments." For this goal, **96%** of faculty artifacts assessed adequately express the goal. Inclusion of those with moderate coverage increases the percentage to **100%**. Thus, this goal is rated as GREEN.

With this large increase in the number of artifacts meeting the learning goals and earning a "green light", it is clear that faculty are making a concerted effort to meeting the goals. One of the most difficult aspects of this assessment in the past was that for most of the artifacts submitted, it was unclear as to which of the learning goals the artifacts were meant to accomplish. For 2013, faculty were asked to

clearly delineate this information which almost all did. We hope that in the future, faculty specifically delineate in either the syllabus or on the rubric/directions themselves which of the learning goals the artifact meets. *With no current faculty rubrics to assess, we can only tentatively assume that the rubrics were similar from 2013 to 2014, thus we assign a GREEN to this part of the assessment.*

C. Artifact Collection: Student Artifact Analysis

No student artifacts were submitted for assessment in AY 2013-2014.

In the past 3 years of assessment, student artifacts were submitted from Biology and Chemistry. Student grades were submitted as artifacts from Physics. The following table summarizes the number of artifacts falling into each of the three major categories:

Overall 2011			
	Red Light (<6)	**Yellow Light (6-9.9)**	**Green Light (10-15)**
Goal 1	1 (16%)	2 (34%)	3 (50%)
Goal 2	3 (15%)	4 (20%)	13 (65%)
Goal 3	0 (0%)	0 (0%)	9 (100%)

Overall 2012			
	Red Light (<6)	**Yellow Light (6-9.9)**	**Green Light (10-15)**
Goal 1	5 (14%)	17 (49%)	13 (37%)
Goal 2	1 (4%)	11 (46%)	12 (50%)
Goal 3	2 (6%)	18 (55%)	13 (39%)

Overall 2013			
	Red Light (<6)	**Yellow Light (6-9.9)**	**Green Light (10-15)**
Goal 1	3 (6%)	13 (27%)	32 (67%)
Goal 2	5 (12%)	15 (35%)	23 (53%)
Goal 3	0 (0%)	10 (22%)	37 (78%)

The number of faculty submitting student artifacts dramatically increased in the last 3 years. From having 35 data points in 2011, we had 92 in 2012 and 138 in 2013. Across all three learning goals, increases in the percentage that were ranked green have increased, and other than goal 2, those ranked red have been reduced. Thus, for the combined student artifacts and faculty-reported student artifacts, the student learning is rated as follows for the 2013 assessment:

- For the first goal, "Students will use logic and the scientific method to analyze the natural world and solve problems": all three departments are rated as GREEN.
- For the second goal, "Students will analyze issues in science which are important both personally and globally": all three departments are rated as GREEN.
- For the third goal, "Students will connect theories and descriptions found in lectures and textbooks with real-world phenomena utilizing appropriate technology in laboratory and field environments": all three departments are rated as GREEN.

Unfortunately, we do not have any student artifacts to assess from the 2013-2014 AY. However, based on the trends from 2011-2013, we can tentatively assume artifacts were of the same caliber and warrant a GREEN rating.

VIII. Trends and Improvement Plans

Assessment of student learning must be an ever-changing and ever-improving process as we strive to understand how we are meeting the needs of the students as well as the learning goals we as departments have set. In previous assessments, we have attempted to assess the Natural Science with a Laboratory Experience courses by asking one faculty member from each department to complete an in-depth analysis of his or her own course that meets the MPSL requirement. This however, is inadequate as it analyzes only a fraction of the courses taught. In the spirit of other MPSL coordinators, the Natural Science with a Laboratory Experience assessment was modified in 2011 to better assess the majority of the courses, with a goal to assess all the courses more in-depth in future academic years.

To increase the depth of the analysis, SIR data, syllabi, assignment descriptions and student artifacts and grades were collected from a varying number of courses and faculty. These were analyzed by specific rubrics where applicable. While this has significantly increased the number of courses assessed, we are still only examining a fraction of those courses taught. Several emails were sent out requesting artifacts during both Fall and Spring semesters for the 2012 and 2013 assessments. Thus, lack of participation was not due to lack of contact. While 100% compliance would be ideal, we feel that 75-85% compliance would give a very accurate representation of how the courses meet the learning goals. We hope that in future years, the following will be requested from all faculty in Biology, Chemistry, and Physics who teach a course that meets this requirement:

1. Copies of an assignment which can be utilized for meeting each of the three learning goals. The learning goals which the assignment meets should be specified by the faculty providing the assignment. It is *strongly recommended* that for future years, faculty specifically delineate in either the syllabus or on the rubric/directions themselves which of the learning goals the artifact meets.
2. Copies of at least three individual student artifacts which reflect the assignments utilized for meeting each of the three learning goals, although copies of all artifacts are preferable so that random artifacts can be chosen for assessment. This would remove skewing of data by the faculty choosing samples from their own classes.

We recognize that for some of these assignments, the student artifacts may still be grades (such as for exams). However, copies of research papers and laboratory notebooks and reports should be easily obtained and provided for the assessment. By making these changes, between 1 and 3 faculty artifacts should be provided for each course, and 3 to 9 student artifacts**.** Given the number of artifacts to be assessed, it is hoped that 2-3 faculty will contribute to the compilation of the assessment report for 2015 and beyond.

Even with these changes in requests and changes to the way the assessment is performed, we still have much less than 100% of our courses being assessed. One response from a faculty member regarding past assessments was that the assessment is inadequate and may not fully evaluate the course with respect to the learning goals. Another faculty response was in regard to the learning goals themselves; many faculty have a heavy writing component to their course as this is a thread in the remainder of MPSL courses, yet we do not specifically assess writing. *For the 2013-2014 academic year, the recommendation of the assessor was for the division to re-evaluate the learning goals, make modifications to the existing ones and possibly include a new learning goal to address scientific writing. However, this was not addressed by the division, nor was an assessor chosen for the 2013-2014 AY, and no faculty or student artifacts were collected.* ***Thus, the recommendation for the 2014-2015 AY is that this be addressed during the first division meeting of Fall 2014, with a new assessor being chosen and all learning goals fully reviewed.***

IX. Conclusion

The departments of Biology, Chemistry, and Physics have developed the following learning goals for students taking a course that satisfies the MPSL Natural Science with Lab non-sequential requirement:

1) (Students will…) Develop an understanding of how to use logic and the scientific method to analyze the natural world and solve problems.

2) Learn about issues in science that are important both personally and globally.

3) Utilize technology in laboratory and field environments in order to connect theories and descriptions found in lectures and textbooks with real-world phenomena.

The courses that students take to satisfy these learning goals come from all three departments and are taught by a substantial majority of the faculty in each department. As a result, the learning experiences of students may vary widely in the process of their study of science.

Faculty are requested to submit artifacts from their course that measure student learning with respect to the above goals, along with artifacts from the students that show their ability to meet the goals. Faculty were then given time to reflect on feedback and make changes before they are assessed again. After the 2013 assessment, a call for a new assessor was made, along with a request to review the learning goals. For the 2013-2014 academic year, no assessor was chosen by the division, the learning goals were not reviewed, and no artifacts were submitted by faculty, thus assessment for this academic year is not possible. Any assessment is circumstantial and based upon the past 3 years of data. However, only one new course and one new faculty member (who taught in a multi-section course) were added for 2013-2014, thus the assumption can be made that courses were consistent with the 2012-2013 academic year.

For 2013, Based upon an assessment of departmental SIR data, the faculty were meeting the needs of the students and were rated as GREEN for Biology and Physics. Scores consistently below the University average in Chemistry led to a ranking of YELLOW. Based upon assessment of course syllabi, the syllabi were rated as GREEN, but for MPSL-specific goals they were rated YELLOW. For specifying assignments which will be used to meet the learning goals, the syllabi were rated as RED.

Learning Goal 1 – Logic, problem solving, and the scientific method were clearly well-established in these courses. Both the faculty assignments and student artifacts received a rating of GREEN.

Learning Goal 2 – In the past, this has been ranked either yellow or green. Recognizing this as a weakness in student learning, faculty have made a conscious effort to include assignments and projects to address this learning goal. Thus, both faculty and student artifacts submitted for those assignments continued to receive a rating of GREEN.

Learning Goal 3 – Faculty have worked extensively to improve student learning under this goal, and students now successfully "connect theories and descriptions found in lectures and textbooks with real-world phenomena." This goal was met considerably well and received a rating of GREEN, with a caution to Physics to submit faculty artifacts that represent this goal in the future.

Thus, for the 2012-2013 AY, the departments rated student learning for all three learning goals as GREEN. *With the assumption that little changes were made for the 2013-2014 AY, we could assume that the goals are again rated GREEN. However, we caution that a new assessor must be chosen in a division meeting in early Fall 2014, and the means of assessment and learning goals be reviewed before the assessment of 2014-2015 AY.*

Respectfully submitted by Dr. Jennifer R. Schroeder, on 6/13/14.