Student Learning in Natural Science with a Laboratory Experience Courses
Self-Study Report
June 2013

Updated from report in June 2012

Respectfully Submitted June 17, 2013
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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. Each year, faculty gather an assortment of artifacts from their courses that measure student learning with respect to the above goals. Using a set of rubrics, these artifacts are evaluated to assess student learning. Prior to 2011, these evaluations have included an extensive evaluation of one course per department that meets the learning goals. In retrospect, this means of assessment is inadequate. Since the 2011 Assessment, several courses have been evaluated from each department to give a more complete overview of whether the goals are being met. Each year all faculty are asked to submit assignment directions and student artifacts from their freshman level courses that may be taken by non-majors, giving us a clearer picture of how our offered courses meet the goals of the Natural Science with a Lab non-sequential requirement.

Based on the rubrics created for assessing the learning goals, our current status on all three learning goals is a "**green light**" (at an acceptable level).

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.

III. Snapshot

The departments of Biology, Chemistry, and Physics at Millikin University were staffed in 2012-13 by 15 full-time faculty, 7 adjunct faculty or instructors, and 1.5 academic staff support people (secretaries). 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 2012 (F) or Spring 2013 (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 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, Hormones & Society – Dr. Jennifer Schultz-Norton (S)
- BI 102, Human Biology – Dr. Cynthia Handler (F,S)
- BI 102, Micro-organisms & Disease – Dr. Sangeetha Srinivasan (F)
- BI 105, Ecology & Evolution – Dr. Judy Parrish, Dr. Marianne Robertson, Dr. Travis Wilcoxen (F)
- BI 155, Ecology & Evolution Lab – Dr. Judy Parrish, Dr. Marianne Robertson, Dr. Travis Wilcoxen, Dr. Sangeetha Srinivasan (F)
- BI 108/158 Diversity of Life – Dr. Judy Parrish, Dr. Jeff Hughes, Dr. Sangeetha Srinivasan (S)
- BI 125, Local Flora – Dr. Judy Parrish (S)
- BI 130, Environmental Biology – Prof. Roslyn O'Conner (F)
- BI 204, Essentials of A&P – Dr. Travis Wilcoxen (S), Dr. Cynthia Handler (F)
- BI 206, A&P I – Dr. Gregg Marcello (F,S)
- BI 207, A&P II – Dr. Travis Wilcoxen (F,S)
- BI 230, Principles of Microbiology – Dr. Jeff Hughes (S), Dr. Sangeetha Srinivasan (F)
- BI 280, Ecological Journey: S. Florida – Dr. Travis Wilcoxen (F)
- CH 121/151, General Chemistry – Prof. Elizabeth Stensrud (F), Prof. Ken Stensrud (F), Dr. Clarence Josefson (S), Dr. Ed Acheson (S), Prof. Lynette Nehmer (F,S), Prof. Katherine Fritts (F,S), Dr. Randall Kok (F), Prof. Marie Gregory (F), Dr. Paris Barnes (F)
- 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. Casey Watson (F)
- PY 152, University Physics II – Dr. Casey Watson (S)
- PY 171, Physics Lab I – Dr. Eric Martell (F), Dr. Casey Watson (F)
- PY 172, Physics Lab II – Dr. Casey Watson (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.

The majors for the students taking courses listed in section III, snapshot, are listed by department below.

Major	Biology	Chemistry	Physics	TOTAL
Accounting	8	1	3	12
Applied Mathematics	2	0	2	4
Art	3	0	1	4
Art Education	0	0	0	0
Art Therapy	1	0	1	2
Athletic Training	19	28	0	47
Biology	150	67	36	253
Biology - Secondary Teaching	4	1	4	9
Business Management	8	0	1	9
Business Undecided	1	0	1	2
Chemistry - Secondary Teaching	0	0	0	0
Chemistry	34	20	21	75
Commercial Art	0	0	0	0
Commercial Music	5	0	2	7
Communication	29	4	10	43
Early Childhood Education	9	3	4	16
Elementary Ed	18	7	4	29
English - Literature	1	0	0	1
English - Secondary Teaching	1	1	3	5
English - Writing	0	0	4	4
Entrepreneurship	1	0	0	1
Exploratory Studies	19	15	5	39
Finance	3	3	1	7
Fitness and Sport	3	1	2	6
Graphic Design	1	0	1	2
Health/Fitness/Recreation	25	5	1	31
History	0	1	0	1
Human Services	30	1	2	33
Information Systems	9	1	1	11

Interdepartmental	0	0	0	0
International Business	0	0	0	0
International Studies	0	0	2	2
Marketing	4	1	2	7
Math - Secondary Teaching	2	0	1	3
Math w/ Actuarial Science	0	0	0	0
Music	2	0	0	2
Music Business	8	0	2	10
Music Ed Instrumental	2	0	1	3
Music Ed Vocal	10	0	0	10
Music Performance Instrumental	2	0	3	5
Music Performance Vocal	3	0	1	4
Musical Theatre	5	0	1	6
Non-Degree	5	1	0	6
Nursing	126	56	0	182
Philosophy	1	0	4	5
Phys Ed (K-12)	12	1	0	13
Physics	1	12	19	32
Political Science	4	1	1	6
Psychology	30	2	10	42
Soc Science Secondary Teach	13	0	0	13
Sociology	0	0	5	5
Spanish	0	0	0	0
Sport Management	16	3	3	22
Stage Management	0	0	0	0
Studio Art	2	0	3	5
Theatre	11	0	3	14
SUM	**643**	**236**	**171**	**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. For example, a student in the Block General Chemistry course will have an intense experience in which lab and lecture are integrated, and they are tested every day to ensure that they keep pace with the material. A student in one of the Biology topics courses may study some of the most controversial topics facing our society and may develop projects that require them to interact with the Decatur community. Students in all courses will be 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. However, it is apparent that certain majors seem more likely to take one department's courses over another to fulfill their requirement: Accounting, communication, and human services majors are more likely to take a Biology course, while athletic training and nursing majors are more likely to take Chemistry. Other majors have a more even distribution among the three departments.

V. Assessment Methods

In past years, a subset of courses has been analyzed to assess the learning goals for the MPSL Natural Science with a Laboratory Experience requirement. 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. However, we realize that this is a strong underrepresentation of the breadth of courses which are offered. As described earlier, there are twenty-seven 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 the 2010-2011 academic year and beyond. An analysis of the number of courses and number of faculty contributing artifacts to the assessment is listed below for the last three academic years.

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. For 2011, the Biology faculty were regarded as RED for contribution to the assessment, Chemistry as YELLOW, and Physics as GREEN. For the 2012 assessment, the Biology faculty was been upgraded to YELLOW and Chemistry was regarded as GREEN for their contributions. Physics however, with the lower participation and such a low percentage of classes being assessed, was rated as RED. With the concession that not all faculty will contribute artifacts even after several requests, we have modified our analysis some and are acknowledging more realistic contributions from each department. For 2013, Chemistry is rated YELLOW as just under 50% of faculty have contributed artifacts, which cover more than one-third of the courses taught. Physics and Biology are rated GREEN as more than half of the faculty submitted artifacts, although the number of courses covered was just over one-third for Biology. In the future, it would be ideal to assess at least half of the faculty and half of the courses offered by each department.

Various artifacts including exams, formal lab write-ups, lab books, semester-long projects, and presentations were also submitted for assessment. These will be assessed in two ways: one branch of the assessment will examine whether the learning goals are clearly addressed in the assignment using the rubric below.

Rubrics for Faculty Directions for Artifact Assessment

Goal 1: Logic and the Scientific Method

Item	Criteria		
	Excellent	Adequate	Unsatisfactory
Scientific Method	**[5 points]** Encourages strong understanding of the scientific method. Ability to develop hypotheses, test them, and then draw appropriate conclusions from the results to be analyzed. Clear understanding of the meaning of the word "theory" in a scientific context.	**[3 points]** Encourages a basic understanding of the scientific method. Focuses upon the individual parts, but does not require students to synthesize them into a coherent whole.	**[1 point]** Does not demonstrate any substantial focus upon the scientific method.
Analysis	**[5 points]** Requires ability to analyze data and explain results. Asks students to draw conclusions from data or calculations. Encourages discussion of results.	**[3 points]** Includes a basic analysis of data. Encourages students to come up with some minor conclusions, without discussion required.	**[1 point]** Fails to require data analysis, conclusions, or comparisons with other data.
Problem Solving	**[5 points]** Encourages use of logic and reasoning to solve complex problems, while incorporating prior knowledge. Comparison to hypothesis is required.	**[3 points]** Includes a basic level of problem solving.	**[1 point]** Fails to show the ability to solve problems beyond the most basic level.

Goal 2: Scientific Issues

Item	Criteria		
	Excellent	Adequate	Unsatisfactory
Understanding of issue	**[5 points]** Requires a clear understanding of a scientific issue. Asks student to explain the scientific principles governing the relevant physics, biology, or chemistry.	**[3 points]** Asks for a basic understanding of a scientific issue. Scientific principles encouraged, but not required.	**[1 point]** Does not ask for in-depth understanding or explanation of basic scientific principles.
Understanding of personal relevance	**[5 points]** Requires a clear understanding of how a scientific issue affects them personally.	**[3 points]** Encourages, but does not require, a small understanding of how a scientific issue affects them personally.	**[1 point]** No correlation between the student and the issue is required.
Understanding	**[5 points]** Requires a clear	**[3 points]** Encourages	**[1 point]** Does

of global relevance	understanding of how a scientific issue affects the world at large, including long-term affects.	an understanding of how a scientific issue affects the global community, but not an in-depth analysis.	not require a connection between scientific issue and other global issues.

Goal 3: Technology in Lab and Field Environments

Item	Criteria		
	Excellent	Adequate	Unsatisfactory
Use of technology	**[5 points]** Faculty has student utilize appropriate technology to acquire and analyze data in an experimental setting. Uses equipment safely and efficiently.	**[3 points]** Asks the student to utilize technology to acquire or analyze data, but not both. May be inefficient, but uses equipment safely.	**[1 point]** Does not ask the student to use appropriate technology in experimental setting. No taking or analysis of data. Demonstrates unsafe procedures.
Connection of theory and experiment	**[5 points]** Requires a connection of experimental results with expectations from class or texts. Asks students to connect theory with results.	**[3 points]** Encourages, but does not require, connection of theoretical expectations with experimental results.	**[1 point]** Does not ask students to connect the results they obtain experimentally with expected results from class or texts.
Connection to real-world phenomena	**[5 points]** Requires comparison of results found in (often) a controlled lab environment to understanding real-world phenomena. Can make predictions about what would happen in a less controlled environment.	**[3 points]** Encourages, but does not require, students to demonstrate connection of lab results with more general real-world phenomena.	**[1 point]** Does not ask student to generalize from results in lab to real-world phenomena. No understanding required beyond the lab environment.

The grading rubrics used to assess each learning goal 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 will examine whether the students met the learning goals through these assignments. The rubrics utilized for assessing the artifacts are provided below. For the artifacts, a random sampling of the submitted work was assessed (with a minimum of two artifacts per course).

Rubrics for Student Artifact Assessment
Goal 1: Logic and the Scientific Method

Item	Criteria		
	Excellent	Adequate	Unsatisfactory
Scientific Method	**[5 points]** Student demonstrates strong understanding of the scientific method. Ability to develop hypotheses, test them, and then draw appropriate conclusions from the results. Clear understanding of the meaning of the word "theory" in a scientific context.	**[3 points]** Student demonstrates a basic understanding of the scientific method. Understands the parts, but unable to synthesize them into a coherent whole.	**[1 point]** Student does not demonstrate any substantial understanding of the scientific method. Cannot differentiate between a theory and a guess.
Analysis	**[5 points]** Student demonstrates ability to analyze data and explain results. Results well-understood and appropriate and justifiable conclusions drawn from data or calculations. Honest comparison with previous results influences discussion of results.	**[3 points]** Student demonstrates a basic ability to analyze data. Some conclusions may be insufficiently well-supported, comparisons with previous results may be incomplete, but basic structure of sound analysis is present.	**[1 point]** Student fails to meet basic standards for appropriate data analysis. Results clearly not well-understood, incomplete analysis, failure to compare with previous results.
Problem Solving	**[5 points]** Student demonstrates a clear grasp of how to use logic and reasoning to solve complex problems. Breaks problem into simpler components that incorporate prior knowledge. Combines information in a useful way. Interprets result appropriately and compares with expectations.	**[3 points]** Student demonstrates a basic ability to solve problems. Logic may be faulty at times, may show difficulties in dealing with more complex problems.	**[1 point]** Student fails to show the ability to solve problems beyond the most basic level.

Goal 2: Scientific Issues

Item	Criteria		
	Excellent	Adequate	Unsatisfactory
Understanding of issue	**[5 points]** Student demonstrates a clear understanding of a scientific issue. Can explain the scientific principles governing	**[3 points]** Student demonstrates an incomplete understanding of a scientific issue. Explanation unclear in	**[1 point]** Student demonstrates a weak understanding

	the relevant physics, biology, or chemistry.	parts, scientific principles insufficiently well-understood.	at best. Unable to explain basic scientific principles.
Understanding of personal relevance	**[5 points]** Student demonstrates a clear understanding of how a scientific issue affects them personally. Can show how they are related to causes and effects. Understands long-term results of effects in their lives.	**[3 points]** Student demonstrates an incomplete understanding of how a scientific issue affects them personally. May not understand how they are related to causes or effects.	**[1 point]** Student unable to draw connections between scientific issue and their own life.
Understanding of global relevance	**[5 points]** Student demonstrates a clear understanding of how a scientific issue affects the world at large. Can draw connections to political, social, or cultural causes and effects. Understands long-term global effects.	**[3 points]** Student demonstrates an incomplete understanding of how a scientific issue affects the global community. May be unable to draw connections to causes and effects.	**[1 point]** Student unable to draw connections between scientific issue and other global issues.

Goal 3: Technology in Lab and Field Environments

Item	Criteria		
	Excellent	Adequate	Unsatisfactory
Use of technology	**[5 points]** Student utilizes appropriate technology to acquire and analyze data in an experimental setting. Uses equipment safely and efficiently.	**[3 points]** Student can utilize technology to acquire or analyze data, but not both. May be inefficient, but uses equipment safely.	**[1 point]** Student unable to use appropriate technology in experimental setting. Cannot take or analyze data. Demonstrates unsafe procedures.
Connection of theory and experiment	**[5 points]** Student connects experimental results with expectations from class or texts. Able to put theory into practice in lab and able to use results to discuss theory.	**[3 points]** Student demonstrates an incomplete ability to connect theoretical expectations with experimental results.	**[1 point]** Student unable to connect the results they obtain experimentally with expected results from class or texts.
Connection to real-world phenomena	**[5 points]** Student is able to generalize from results found in (often) a controlled lab environment to understand real-world phenomena. Can make predictions about what would happen in a less controlled environment.	**[3 points]** Student demonstrates an incomplete ability to connect lab results with more general real-world phenomena. May not be able to understand what happens in a less-controlled environment.	**[1 point]** Student unable to generalize from results in lab to real-world phenomena. Does not demonstrate understanding beyond lab environment.

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 have been collected for the following four items: (1) scale summary data for course organization and planning, (2) scale summary data for communication, (3) overall evaluation of the instructor, and (4) overall evaluation of the course. The following SIR data compare the mean scores for all faculty at the university (first number) with average mean scores for faculty within the Division of Natural Sciences (only including Biology, Chemistry, and Physics). The individual department SIR scores are included as well. Unfortunately, data for only the courses which were used for assessing the Natural Sciences with a Laboratory Experience is not available, and thus all courses in the major are included in the data below.

Fall 2010	University	Division (NS)	Biology	Chemistry	Physics
Course Organizaton & Planning	4.34	4.45	4.38	4.44	4.61
Communication	4.41	4.52	4.51	4.47	4.62
Overall, Instructor	4.37	4.49	4.45	4.43	4.66
Overall, Course	4.18	4.3	4.26	4.27	4.47
Number Reporting	6014 (49%)	654 (63%)	309 (70%)	213 (48%)	132 (80%)

Spring 2011	University	Division (NS)	Biology	Chemistry	Physics
Course Organizaton & Planning	4.39	4.40	4.43	4.29	4.51
Communication	4.46	4.49	4.53	4.41	4.54
Overall, Instructor	4.41	4.41	4.48	4.26	4.50
Overall, Course	4.23	4.17	4.27	4.01	4.18
Number Reporting	3690 (36%)	458 (56%)	223 (67%)	157 (44%)	78 (60%)

Fall 2011	University	Division (NS)	Biology	Chemistry	Physics
Course Organization & Planning	4.37	4.26	4.34	4.11	4.33
Communication	4.43	4.36	4.52	4.16	4.37
Overall, Instructor	4.36	4.22	4.40	4.04	4.17
Overall, Course	4.18	3.96	4.23	3.82	3.99
Number Reporting	5214 (44%)	649 (64%)	283 (72%)	224 (54%)	142 (69%)

Spring 2012	University	Division (NS)	Biology	Chemistry	Physics
Course Organization & Planning	4.35	4.30	4.35	4.22	4.32
Communication	4.43	4.43	4.52	4.32	4.39
Overall, Instructor	4.38	4.38	4.48	4.23	4.29
Overall, Course	4.22	4.14	4.23	4.00	4.16
Number Reporting	6331 (56%)	676 (73%)	328 (78%)	225 (66%)	123 (79%)

Fall 2012	University	Division (NS)	Biology	Chemistry	Physics
Course Organizaton & Planning	4.38	4.35	4.41	4.20	4.40
Communication	4.44	4.40	4.55	4.19	4.54
Overall, Instructor	4.38	4.33	4.47	4.06	4.49
Overall, Course	4.23	4.10	4.22	3.90	4.25
Number Reporting	7363 (60%)	1209 (72%)	401(81%)	383 (65%)	97 (73%)

Spring 2013	University	Division (NS)	Biology	Chemistry	Physics
Course Organizaton & Planning	4.33	4.34	4.38	4.25	4.53
Communication	4.41	4.43	4.54	4.26	4.62
Overall, Instructor	4.33	4.37	4.51	4.13	4.64
Overall, Course	4.19	4.12	4.22	3.92	4.45
Number Reporting	4977 (46%)	634 (62%)	310 (76%)	255 (54%)	69 (51%)

B. Syllabus Audit Data

For the academic year 2012-2013, 54 total syllabi were collected. This represents syllabi for a majority of the courses which meet the Natural Science with a Laboratory Experience requirement. Each syllabus was audited to see if it contained specific items relevant to the delivery and assessment of the Natural Science with a Laboratory Experience learning goals. The following data provides information regarding the number of syllabi containing the relevant items as specified on the audit form.

Natural Science with a Laboratory Experience
Syllabus Audit Form

	Syllabus is acceptable on item	Syllabus has item included but not in acceptable form	Syllabus does not have item
TOP of FIRST PAGE: Course Identification: course number, course name, faculty, semester	100% (54)	0%	0%
SOMEWHERE in SYLLABUS:			
Faculty contact info: name, office, office hours, office phone, email address	94.4% (51)	0%	5.6% (3)
Course description: Standard description plus faculty written course description/overview	88.9% (48)	0%	11.1% (6)
Standard course learning goals	100% (54)	0%	0%
MPSL learning goals	63.0% (34)	0%	27.0% (20)
Instructor's grading policy - scale and weights for assignments & for the semester	100% (54)	0%	0%
Instructor's attendance policy – penalties	94.4% (51)	0%	0% (3)
Academic honesty & integrity statement (standard)	100% (54)	0%	0%
University disability statement (standard)	9.3% (5)	1.9% (1)	88.8% (48)
Specification of a written assignment that will serve as Logic and the Scientific Method artifact for assessment purposes	9.3% (5)	1.9% (1)	88.8% (48)
Specification of a written assignment that will serve as Scientific Issues artifact for assessment purposes	9.3% (5)	1.9% (1)	88.8% (48)
Specification of a written assignment that will serve as Technology in the Lab and Field Environments artifact for assessment purposes	9.3% (5)	1.9% (1)	88.8% (48)

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 seems 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. Over the last two academic years, 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.

One of the most difficult aspects of this assessment is in isolating the specific artifacts which are then utilized in the assessment, as many of these learning goals are incorporated throughout the entire course and may not have only one assignment which could be utilized for assessment for each goal. 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, this is still a daunting task; however the assessor realizes 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.

To try to identify whether specific assignments are well-designed to meet the learning goals, artifacts representing the directions and/or rubrics for these assignments were collected from several faculty covering a variety of courses. Each item on the rubric was analyzed for each faculty-provided assignment. Some of these were directed at meeting a specific learning goal rather than all three goals, thus the number of artifacts for each goal varies. A similar assessment was performed for all student artifacts submitted. These artifacts represent the faculty who provided data as reported in section V. A hard copy of each of the artifacts collected along with the individual assessment is available in the Biology office suite.

For each of the artifacts, faculty were asked to specify which goals were met by the rubric. If that was not provided, the assessor determined which of the goals was being met by the assignment and scored each of the three categories under the proper goals. The assessor on all of these artifacts was Dr. Jennifer Schultz-Norton. For each of the subcategories under the learning goals, a rubric score between 1 and 5 was assigned. On the basis of its total score, the artifact is tagged as falling into one of three categories:

- 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 following tables identify the number of FACULTY artifacts falling into each of the three major categories:

Biology			
	Red Light (<6)	**Yellow Light (6-9.9)**	**Green Light (10-15)**
Goal 1	0 (0%)	1 (5%)	18 (95%)
Goal 2	0 (0%)	4 (25%)	12 (75%)
Goal 3	0 (0%)	0 (0%)	20 (100%)

Chemistry			
	Red Light (<6)	**Yellow Light (6-9.9)**	**Green Light (10-15)**
Goal 1	0 (0%)	1 (10%)	9 (90%)
Goal 2	0 (0%)	3 (50%)	3 (50%)
Goal 3	0 (0%)	1 (20%)	4 (80%)

Physics			
	Red Light (<6)	**Yellow Light (6-9.9)**	**Green Light (10-15)**
Goal 1	0 (0%)	0 (0%)	1(100%)
Goal 2	0 (0%)	0 (0%)	1(100%)
Goal 3	N/A	N/A	N/A

After adding up and averaging the scores for the individual departments, the rubric scores 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

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

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 (2012)			
	Goal 1	**Goal 2**	**Goal 3**
Biology	36	36	33
Chemistry	21	6	13
Physics	2	0	0
Overall	59	42	46

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

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

The following tables identify the number of STUDENT artifacts falling into each of the three major categories:

Biology			
	Red Light (<6)	**Yellow Light (6-9.9)**	**Green Light (10-15)**
Goal 1	2 (7%)	6 (23%)	18 (69%)
Goal 2	1 (4%)	6 (22%)	20 (74%)
Goal 3	0 (0%)	5 (19%)	21 (81%)

Chemistry			
	Red Light (<6)	**Yellow Light (6-9.9)**	**Green Light (10-15)**
Goal 1	1 (5%)	5 (25%)	14 (70%)
Goal 2	4 (33%)	7 (58%)	1 (8%)
Goal 3	0 (0%)	5 (25%)	15 (75%)

Physics			
	Red Light (<6)	**Yellow Light (6-9.9)**	**Green Light (10-15)**
Goal 1	0 (0%)	1 (50%)	1 (50%)
Goal 2	0 (0%)	0 (0%)	2 (100%)
Goal 3	0 (0%)	0 (0%)	1 (100%)

After adding up and averaging the scores for the individual departments, the rubric scores 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

In past evaluations, several faculty submitted student grades for their own courses as a means of assessment. These submitted only for Physics, and comprised the entirety of student artifacts in Physics. Scoring was obtained based upon overall class averages on each assignment. For these courses, reported

grades of 90-100% were scored with 5 points, 80-89% with 4 points, 70-79% with 3 points, 60-69% with 2 points, and 59 and below 1 point. If the student failed to submit the assignment, a 0 was given. On the basis of its total score, the artifact is tagged as falling into one of three categories:

- For totals between 3.5 and 5, 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 2 and 3.5, 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 2, 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.

Both faculty in Physics submitted student grades, covering five of their courses. The following table identifies the number of courses falling into each of the three major categories:

Physics			
	Red Light (<2)	**Yellow Light (2-3.5)**	**Green Light (3.5-5)**
Goal 1	0 (0%)	2 (100%)	0 (0%)
Goal 2	0 (0%)	2 (50%)	2 (50%)
Goal 3	0 (0%)	0 (0%)	1 (100%)

VII. Analysis

A. SIR Data

For the third year in a row, we are including SIR data in our assessment of the Natural Sciences with a Laboratory Experience courses. This is being included to demonstrate the quality of the faculty teaching this university requirement. Although the SIR data included here are not ideal, as they include both courses for the MPSL as well as major-specific courses, they do give an indication of the quality of the faculty in the Natural Sciences for Course Organization and Planning, Communication, Overall Instructor and Overall Course.

As we have observed in the past, a higher number of students have participated in assessment of Chemistry and Physics courses than Biology courses. Scores in Biology were the same or higher than in the 2011/2012 academic year. Chemistry had a very slight increase in Fall but decrease in Spring in this same time period, while Physics had a large increase in their scores.

As the numbers for the most part are above, at or near the university averages, we score the SIR Data as GREEN for Biology and Physics. For the last five semesters, Chemistry has been below the university averages and thus is rated YELLOW.

B. Syllabi Audits

The 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 hope to see near (if not actual) 100% marks in the future. We hope that faculty will continue to update their syllabi to address the learning goals and delineate how they will be assessed. 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**

C. Artifact Collection: Rubric and directions analysis

Faculty and student artifacts were submitted from Biology and Chemistry. For Physics, two faculty artifacts were accessible from a past assessment, and some student grades were submitted as student artifacts. 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	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%)

This is the third year that the directions and rubrics themselves are being analyzed for their ability to effectively demonstrate the learning goals. 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.

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.

D. Artifact Collection: Student Artifact Analysis

Faculty and 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%)

Similar to what was seen with the faculty directions/rubrics, the number of faculty submitting student artifacts dramatically increased. 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. Based upon this analysis, it would appear that for 2012, these three goals should be ranked as GREEN.

Thus, for the combined student artifacts and faculty-reported student artifacts, the student learning is rated as follows:

- 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.

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. 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 2014 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 is to re-evaluate the learning goals, make modifications to the existing ones and possibly include a new learning goal to address scientific writing.**

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. These artifacts are studied individually, departmentally, and within the science departments as a whole in order to better understand how faculty collectively work to help students achieve learning goals. Faculty will then be given time to reflect on feedback and make changes before they are assessed again. While all faculty teaching courses that meet the Natural Science with a Lab non-sequential requirement are asked to submit artifacts, several do not which limits the assessment.

Based upon an assessment of departmental SIR data, the faculty are meeting the needs of the students and are rated as GREEN for Biology and Physics. Scores consistently below the University average in Chemistry lead to a ranking of YELLOW.

Based upon assessment of course syllabi, the learning goals are much better displayed than in previous assessments. For the inclusion of overall course learning goals, the syllabi are rated as GREEN, but for MPSL-specific goals they are rated YELLOW. For specifying assignments which will be used to meet the learning goals, the syllabi are rated as RED.

Learning Goal 1 – Logic, problem solving, and the scientific method are clearly well-established in these courses. This is something that science courses generally do well, and our data supports that argument. Both the faculty assignments and student artifacts receive a rating of GREEN.

Learning Goal 2 – While there are some issues in science which have a clear-cut impact on one personally or in a global context, others may not be so easy to discern. 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 continue 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 by both faculty assignments and student artifacts and receives a rating of GREEN, with a caution to Physics to submit faculty artifacts that represent this goal in the future.

For the 2012-2013 AY, the departments rate student learning for all three learning goals as GREEN.

Respectfully submitted by Dr. Jennifer R. Schultz-Norton, on 6/17/13.