**Student Learning in Natural Science with a Laboratory Experience Courses**
**Self-Study Report**
**June 2011**




**Respectfully Submitted July 1, 2011**
**By Jennifer Schultz-Norton, 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 substantial 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, faculty then evaluate the artifacts to assess student learning. In the past, 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. Using the recent evaluations of the sequential learning requirements as a guide, this annual evaluation assesses the goals of more courses offered to meet the Natural Science with a Lab non-sequential requirement. While not all courses offered have been evaluated in this annual evaluation, we feel this is a substantial improvement in our assessment technique and will continue to improve in future evaluations.

Based on the rubrics created for assessing the learning goals, our current status on all three learning goals is a tentative "**green light**" (at an acceptable level). The Natural Science faculty will continue to work on ways to ensure that all our students perform at the "green light" level in the future.

## 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 2010-11 by 17 full-time faculty, 5 adjuncts, 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. Another biology faculty (Roslyn O'Conner) has a full-time position with half of her load directed to teaching and half to 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. 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 24 students.

Courses taught Fall 2010 (F), January Immersion 2011 (J), Spring 2011 (S), or Summer 2011 (Su) that met the MPSL Natural Science with a Laboratory Experience requirement:

BI 102, Biochemistry of Food – Dr. Samuel Galewsky (F)
BI 102, Human Genetics – Dr. Terry C. Matthews (F)
BI 102, Hormones & Society – Dr. Jennifer R. Schultz-Norton (F, Su)
BI 102, Biology of Birds – Dr. David J. Horn (F, S)
BI 102, Ecology – Fragmented Landscapes – Dr. Gregg Marcello (F)
BI 102, Human Biology – Dr. Jennifer R. Schultz-Norton (S)
BI 102, Current Issues in Biology – Prof. Roslyn J. O'Conner (S)
BI 102, Biology of Disease – Dr. Jeffrey A. Hughes (S)
BI 102, Pay it Forward – Dr. David J. Horn (S)
BI 102, Human Physiology in Space – Dr. Harold L. Wilkinson (J)
BI 102, Biology in the Bay of Fundy – Dr. Judith A. Parrish (Su)
BI 105/155, Ecology & Evolution – Dr. Judith Parrish and Dr. Marianne Robertson (F)
BI 125, Local Flora – Dr. Judith Parrish (S)
BI 130, Environmental Biology – Prof. Roslyn J. O'Conner (F)
BI 204, Essentials of Anatomy & Physiology – Dr. Travis Wilcoxen (F), Dr. Cynthia Handler (S)
BI 220, Field Ecology – Dr. Judith Parrish (Su)
BI 280, Ecological Journey: Galapagos – Dr. David J. Horn (S)

IN 204, Biology of Spiders – Dr. Marianne Robertson (S)

CH 102, History of Science & Technology – Prof. Gwendalyn C. Baumann
CH 121/151, General Chemistry – Dr. Edward Acheson, Dr. Clarence M. Josefson, Prof. Gwendalyn C. Baumann, Prof. Lynette D. Nehmer, Prof. Patricia A. Higgins, Prof. Frederick N. Strine (F, S)

PY 100/104, The Planets – Dr. Casey R. Watson (S)
PY 101/105, Stars and Galaxies – Dr. Casey R. Watson (F)
PY 111, College Physics 1 – Dr. Eric C. Martell (F)
PY 151, University Physics 1 - Dr. Casey R. Watson (F)

## 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. The full breakdown of majors enrolled in each individual course is include in Appendix 1.

| Major | Biology | Chemistry | Physics | Total |
|---|---|---|---|---|
| Accounting | 16 | 3 | 2 | 21 |
| Applied Mathematics | 1 | 1 | 2 | 4 |
| Art | 2 | 0 | 0 | 2 |
| Art Education | 1 | 0 | 0 | 1 |
| Art Therapy | 6 | 0 | 1 | 7 |
| Athletic Training | 0 | 25 | 1 | 26 |
| Biology | 46 | 44 | 33 | 123 |
| Biology - Secondary Teaching | 6 | 3 | 1 | 10 |
| Business Management | 4 | 1 | 1 | 6 |
| Business Undecided | 7 | 1 | 4 | 12 |
| Chemistry - Secondary Teaching | 1 | 0 | 2 | 3 |
| Chemisty | 10 | 7 | 10 | 27 |
| Comm Art | 1 | 0 | 0 | 1 |
| Commercial Music | 9 | 1 | 8 | 18 |
| Communication | 21 | 0 | 4 | 25 |
| Early Childhood Education | 14 | 1 | 4 | 19 |
| Elementary Ed | 12 | 3 | 10 | 25 |
| English - Literature | 1 | 0 | 0 | 1 |
| English - Secondary Teaching | 6 | 0 | 0 | 6 |
| English - Writing | 4 | 0 | 3 | 7 |
| Entrepreneurship | 1 | 1 | 0 | 2 |
| Exploratory Studies | 10 | 12 | 1 | 23 |
| Finance | 2 | 1 | 0 | 3 |
| Fitness and Sport | 36 | 19 | 2 | 57 |
| Graphic Design | 1 | 0 | 0 | 1 |
| History | 4 | 0 | 1 | 5 |
| Human Services | 19 | 2 | 2 | 23 |
| Information Technology | 1 | 1 | 1 | 3 |
| Interdepartmental | 0 | 4 | 2 | 6 |

| Major | Biology | Chemistry | Physics | Total |
|---|---|---|---|---|
| International Business | 2 | 0 | 1 | 3 |
| International Studies | 1 | 1 | 0 | 2 |
| Marketing | 2 | 1 | 3 | 6 |
| Math - Secondary Teaching | 5 | 0 | 0 | 5 |
| Math w/ Actuarial Science | 0 | 0 | 3 | 3 |
| Music | 2 | 1 | 1 | 4 |
| Music Business | 3 | 0 | 5 | 8 |
| Music Ed Instrumental | 2 | 0 | 0 | 2 |
| Music Ed Vocal | 5 | 0 | 6 | 11 |
| Music Performance Instrum | 2 | 0 | 1 | 3 |
| Music Performance Vocal | 7 | 1 | 3 | 11 |
| Musical Theatre | 11 | 0 | 0 | 11 |
| Non-Degree | 2 | 0 | 0 | 2 |
| Nursing | 4 | 42 | 3 | 49 |
| Philosophy | 4 | 0 | 0 | 4 |
| Phys Ed (K-12) | 16 | 11 | 0 | 27 |
| Physics | 2 | 3 | 5 | 10 |
| Psychology | 15 | 1 | 4 | 20 |
| Sociology | 9 | 1 | 3 | 13 |
| Spanish | 2 | 0 | 1 | 3 |
| Sport Management | 0 | 0 | 1 | 1 |
| Stage Management | 1 | 0 | 0 | 1 |
| Studio Art | 6 | 0 | 0 | 6 |
| Theatre | 23 | 0 | 6 | 29 |
| **SUM** | **368** | **192** | **141** | **701** |

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. There are some commonalities which all students will experience, such as a full-time faculty or staff member as an instructor and extensive hands-on laboratory experiences (between 24 and 45 hours in the lab, depending on the course), but 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 and deal with issues such as conservation and recycling. A student in Stars and Galaxies will become an expert at setting up, taking down, and maintaining a telescope, and learn what it is about the night sky that has captivated mankind for millennia. 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 departments' 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 recent years, a subset of courses has been analyzed to assess the learning goals for the MPSL Natural Science with a Laboratory Experience requirement. 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-four different course titles which meet the requirement, and many of these are offered multiple times throughout the year. Thus, assessing only three courses, less than one-fourth what is offered, is 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 is being assessed for the 2010-2011 academic year. This includes a majority of the Physics courses (with faculty and student artifacts provided from all but the lab sections), one course in Chemistry taught by multiple faculty (CH 121/151), and several courses in Biology. However, this is still inadequate. An analysis of the number of courses and number of faculty contributing artifacts to the assessment is listed below.

| | **Courses Analyzed** | | **Faculty Participating** | |
|---|---|---|---|---|
| | **Number** | **Percentage** | **Number** | **Percentage** |
| **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** |

With only a third of biology courses being assessed, and less than 50% of the biology faculty teaching these courses providing artifacts, this is clearly in the RED when it comes to assessment. Chemistry has fared better, with 60% of the faculty providing some artifact, but it still only covers 50% of their course sections. Thus, their contribution is labeled as YELLOW. Physics had the greatest contribution, with both faculty providing not only artifacts but a detailed self-assessment of the learning goals for their courses. The lower percentage for the courses analyzed is due to no artifacts (other than grades) being provided for the PY 171 labs. For Physics, their overall contribution to the assessment is rated as GREEN. In future assessments, we hope to analyze closer to 100% of the courses in all departments.

To begin our analysis, we have included SIR data to discern whether the students feel that the learning goals are being met.

For each of the courses assessed, an analysis of the syllabi was performed to examine whether the learning goals are clearly addressed.

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 of global relevance | **[5 points]** Requires a clear understanding of how a scientific issue affects the world at large, including long-term affects. | **[3 points]** Encourages an understanding of how a scientific issue affects the global community, but not an in-depth analysis. | **[1 point]** Does 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 the relevant physics, biology, or chemistry. | **[3 points]** Student demonstrates an incomplete understanding of a scientific issue. Explanation unclear in parts, scientific principles insufficiently well-understood. | **[1 point]** Student demonstrates a weak understanding 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 | 654 | 309 | 213 | 132 |

| **Spring 2011** | University | Division (NS) | Biology | Chemistry | Physics |
|---|---|---|---|---|---|
| Course Organizaton & Planning | 4.39 | 4.40 | 4.43 | 4.29 | 4.64 |
| Communication | 4.46 | 4.49 | 4.53 | 4.41 | 4.79 |
| Overall, Instructor | 4.41 | 4.41 | 4.48 | 4.26 | 4.86 |
| Overall, Course | 4.23 | 4.17 | 4.27 | 4.01 | 4.64 |
| Number Reporting | 3690 | 458 | 223 | 157 | 42 |

### B. Syllabus Audit Data

For the academic year 2010-2011, 29 total syllabi were collected. This represents syllabi for a majority of the courses which meet the Natural Science with a Laboratory Experience requirement. A few select syllabi for immersion courses were unavailable for assessment. 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 | 28 (93%) | 2 (7%) | |
| **SOMEWHERE in SYLLABUS:** | | | |
| Faculty contact info: name, office, office hours, office phone, email address | 27 (90%) | 1 (3%) | 2 (7%) |
| Course description: Standard description plus faculty written course description/overview | 9 (30%) | 2 (70%) | |
| Standard course learning goals | 19 (63%) | 6 (20%) | 5 (17%) |
| Instructor's grading policy - scale and weights for assignments & for the semester | 26 (86%) | 4 (14%) | |
| Instructor's attendance policy – penalties | 26 (87%) | 1 (3%) | 3 (10%) |
| Academic honesty & integrity statement (standard) | 28 (93%) | | 2 (7%) |
| University disability statement (standard) | 28 (93%) | | 2 (7%) |
| Specification of a written assignment that will serve as Logic and the Scientific Method artifact for assessment purposes | 6 (20%) | 2 (7%) | 22 (73%) |
| Specification of a written assignment that will serve as Scientific Issues artifact for assessment purposes | 6 (20%) | 3 (10%) | 21 (70%) |
| Specification of a written assignment that will serve as Technology in the Lab and Field Environments artifact for assessment purposes | 6 (20%) | 2 (7%) | 22 (73%) |

### C. Artifact Collection: Rubric and directions analysis

In previous years, three faculty members have been selected to assess their own courses that meet the MPSL requirement. As this covers barely ten percent of the courses taught, a more comprehensive assessment is required.

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.

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, and within all three departments. These artifacts represent the faculty who provided data as reported in section IV. A hard copy of each of the artifacts collected along with the individual assessment is in the possession of Dr. Jennifer Schultz-Norton.

Each item on the rubric was analyzed for each faculty-provided assignment directions. 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. The raw data for this assessment can be found in Appendix 3.

On each of the artifacts, 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 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%) | 0 (0%) | 6 (100%) |
| **Goal 2** | 2 (22%) | 3 (33%) | 4 (44%) |
| **Goal 3** | 0 (0%) | 0 (0%) | 7 (100%) |

| Chemistry | | | |
|---|---|---|---|
| | **Red Light (>6)** | **Yellow Light (6-9.9)** | **Green Light (10-15)** |
| **Goal 1** | 0 (0%) | 1 (25%) | 3 (75%) |
| **Goal 2** | 0 (0%) | 0 (0%) | 1 (100%) |
| **Goal 3** | 0 (0%) | 0 (0%) | 2 (100%) |

| Physics | | | |
|---|---|---|---|
| | **Red Light (>6)** | **Yellow Light (6-9.9)** | **Green Light (10-15)** |
| **Goal 1** | 0 (0%) | 0 (0%) | 4 (100%) |
| **Goal 2** | 0 (0%) | 0 (0%) | 3 (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 | | | |
|---|---|---|---|
| | **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 | | | |
|---|---|---|---|
| | **Goal 1** | **Goal 2** | **Goal 3** |
| **Biology** | 6 | 9 | 7 |
| **Chemistry** | 3 | 1 | 2 |
| **Physics** | 4 | 3 | 0 |
| **Overall** | 13 | 13 | 9 |

### D. Artifact Collection: Student Artifact Analysis

In previous years, three faculty members have been selected to assess their own courses that meet the MPSL requirement. This year all faculty were asked to submit the artifacts to the assessment coordinator so all artifacts would be analyzed equally.

Student artifacts were submitted from courses in Biology and Chemistry, but no individual student artifacts were submitted by Physics. A hard copy of each of the artifacts collected along with the individual assessment is in the possession of Dr. Jennifer Schultz-Norton. Each item on the rubric was analyzed for student success. Some of these were collected artifacts were directed at meeting a specific learning goal rather than all three goals, thus the number of artifacts for each goal varies. The raw data for this assessment can be found in Appendix 3.

On each of the artifacts, 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 artifacts falling into each of the three major categories:

| **Biology** | | | |
|---|---|---|---|
| | **Red Light (>6)** | **Yellow Light (6-9.9)** | **Green Light (10-15)** |
| **Goal 1** | 1 (25%) | 2 (50%) | 1 (25%) |
| **Goal 2** | 3 (15%) | 4 (20%) | 13 (65%) |
| **Goal 3** | 0 (0%) | 0 (0%) | 7 (100%) |

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

| **Physics** | | | |
|---|---|---|---|
| | **Red Light (>6)** | **Yellow Light (6-9.9)** | **Green Light (10-15)** |
| **Goal 1** | N/A | N/A | N/A |
| **Goal 2** | N/A | N/A | N/A |
| **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 | | | |
|---|---|---|---|
| | **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 | | | |
|---|---|---|---|
| | **Goal 1** | **Goal 2** | **Goal 3** |
| **Biology** | 4 | 20 | 4 |
| **Chemistry** | 2 | 0 | 2 |
| **Physics** | 0 | 0 | 0 |
| **Overall** | 6 | 20 | 6 |

| | **Courses Analyzed** | | **Faculty Participating** | |
|---|---|---|---|---|
| | **Number** | **Percentage** | **Number** | **Percentage** |
| **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 |

Although this severely under represents the courses offered, four faculty submitted individual assessments of their own courses (covering six courses), and three additional faculty provided student grades for the faculty assignments assessed (covering an additional 5 courses). 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.

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

| Biology | | | |
|---|---|---|---|
| | **Red Light (>2)** | **Yellow Light (2-3.5)** | **Green Light (3.5-5)** |
| **Goal 1** | 0 (0%) | 0 (0%) | 5 (100%) |
| **Goal 2** | 0 (0%) | 0 (0%) | 5 (100%) |
| **Goal 3** | 0 (0%) | 0 (0%) | 5 (100%) |

| Chemistry | | | |
|---|---|---|---|
| | **Red Light (>2)** | **Yellow Light (2-3.5)** | **Green Light (3.5-5)** |
| **Goal 1** | 0 (0%) | 1 (50%) | 1 (50%) |
| **Goal 2** | 0 (0%) | 0 (0%) | 1 (100%) |
| **Goal 3** | 0 (0%) | 0 (0%) | 1 (100%) |

| Physics | | | |
|---|---|---|---|
| | **Red Light (>2)** | **Yellow Light (2-3.5)** | **Green Light (3.5-5)** |
| **Goal 1** | 0 (0%) | 0 (0%) | 4 (100%) |
| **Goal 2** | 0 (0%) | 0 (0%) | 3 (100%) |
| **Goal 3** | 0 (0%) | 0 (0%) | 4 (100%) |

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

| Average of Rubric Scores | | | |
|---|---|---|---|
| | **Goal 1** | **Goal 2** | **Goal 3** |
| **Biology** | 4.17 | 4.42 | 4.21 |
| **Chemisty** | 3.85 | 4.00 | 4.29 |
| **Physics** | 4.33 | 4.67 | 4.38 |
| **AVERAGE** | 4.17 | 4.46 | 4.28 |

## VII. Analysis

### A. SIR Data

This is the first time in our assessment of the Natural Sciences with a Laboratory Experience courses that SIR data have been collected for review. This is now 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.

During the Fall 2010 semester, faculty in Biology, Chemistry, and Physics as a whole exceeded the university-wide averages for Course Organization and Planning, Communication, Overall Instructor and Overall Course. In Spring 2011, these numbers were slightly lower than the university average in

Chemistry. However, the low reporting of overall numbers, with only 39% of students university-wide submitting evaluations in Spring 2011, raises question as to the validity of the numbers and the weight they may play in this assessment. As the numbers for the most part are above, at or near the university averages, we score the SIR Data as GREEN for this assessment.

### B. Syllabi Audits

The syllabi were audited under a formal rubric that is very similar to the rubric utilized for the IN 140 assessment. This rubric was not distributed to faculty in advance, and it is evident that some areas are severely lacking. This rubric will be distributed each summer as a reminder of the information that should be included on a syllabus for a course meeting the Natural Science with a Laboratory Experience requirement.

Unfortunately, there was not 100% compliance in any of the categories audited. The more general issues are described below:

- Two syllabi did not specify the semester the course met.
- Email or office hours information was missing or inadequate for two syllabi.
- While course descriptions were present on all syllabi, the majority (69%) failed to include the course description from the catalog.
- A majority of the courses included the course learning goals. However, since some of these courses are also associated with a specific major, they often have those goals listed instead. Future syllabi will be encouraged to include all relevant learning goals.
- A majority of the syllabi included specific grading policies, although a few failed to include a grading scale (percentage associated with A-F and whether +/- would be utilized).
- All but two syllabi included the standard honesty and integrity and disability statements.

What is more disturbing is that in only 20% of the syllabi, specific assignments are earmarked as being utilized for assessment. It becomes clear when perusing the syllabi (see Appendix 1), that these learning goals are most likely being met at some point during the semester. Many of the faculty could most likely provide an artifact which they feel assesses each specific learning goal. However, tangible evidence for supporting that these goals have been met is lacking. It will be **strongly** encouraged that in future academic years, these artifacts be clearly marked as such for use for assessment purposes.

We should expect to see near (if not actual) 100% marks in the future. Faculty teaching the course need make sure that they revise their syllabi to meet the criteria identified in the audit form. We score the audit assessment as follows for 2011:

| | |
|---|---|
| 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 | **YELLOW** |
| Standard course 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

The following table summarizes the number of artifacts falling into each of the three major categories:

| | **Overall** | | |
|---|---|---|---|
| | **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%) |

This is the first time that the directions and rubrics themselves are being analyzed for their ability to effectively demonstrate the learning goals. Thus, there is no baseline to compare them to from past assessments. However, we can make some cautious judgments based upon the data provided.

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." Thus, this is rated as GREEN.

For the second goal, only **62%** of the faculty artifacts submitted to meet the learning goal adequately expressed how the students would be able to "analyze issues in science which are important both personally and globally." Since **85%** of the faculty have at least a moderate coverage of the goal, this goal is rated as YELLOW.

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 faculty artifacts assessed adequately express the goal. Thus, this goal is rated as GREEN.

### D. Artifact Collection: Student Artifact Analysis

The following table summarizes the number of artifacts falling into each of the three major categories:

| | **Overall** | | |
|---|---|---|---|
| | **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%) |

Based upon this analysis, it would appear that only goal 3 has a solid GREEN rating, while goals 1 and 2 are more borderline YELLOW/GREEN. Unfortunately, this only represents four courses from two departments, and thus by itself is ineffective as an analysis.

Additional data was collected from 11 courses (there was a 3 course overlap), although individual student artifacts were not obtained. Many faculty reported overall grades on either individual assignments or class averages. These were converted to rubric score points, tallied and averaged.

| Overall | | | |
|---|---|---|---|
| | **Red Light (>2)** | **Yellow Light (2-3.5)** | **Green Light (3.5-5)** |
| **Goal 1** | 0 (0%) | 1 (9%) | 10 (91%) |
| **Goal 2** | 0 (0%) | 0 (0%) | 9 (100%) |
| **Goal 3** | 0 (0%) | 0 (0%) | 10 (100%) |

These data show that the student artifacts, as reported by the faculty, meet the learning goals in all but one category. For that specific chemistry course, the faculty reported that the students were borderline for meeting the goal and either just missed or just made the goal depending on which artifacts were utilized.

These results were combined based upon the rating for the course and the number of students enrolled. All data from each department was added up and a weighted average was taken.

| | **Goal 1** | **Goal 2** | **Goal 3** |
|---|---|---|---|
| **Biology** | 4.1 | 4.3 | 4.1 |
| **Chemistry** | 3.6 | 4.0 | 4.3 |
| **Physics** | 4.3 | 4.6 | 4.4 |
| **AVERAGE** | 4.1 | 4.3 | 4.3 |

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 this year 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 and thus any rating for this academic year must be a tentative one.

One of our largest goals for upcoming academic years will be in faculty compliance. We need to increase the number of faculty who are submitting artifacts to show how they are assessing the learning goals, and these need to be clearly delineated in the syllabi. We also need to increase the number of student artifacts. This can be done in one of two ways: either by increasing the number of actual student assignments that are given to the assessment coordinator, or by increasing the number of faculty who report grades on said assignments. The preferable way would be the former, as this allows for a consistent assessment of all student artifacts. There is inherent bias in the latter, as overall comprehension of subject material may not fully reflect adequate comprehension of the learning goals. This would be dependent upon the assignment rubric itself and how well the assignment meets the learning goals. As demonstrated in sections VI.C. and VII.C., not all assignments effectively require the students to have a firm comprehension of each learning goal.

While faculty participation was lacking, part of the reason for this was that the change to how the assessment would be done was made during Spring 2011, and thus not as many artifacts were available from the Fall courses. For 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 each assignment which can be utilized for meeting each of the three learning goals.
2. Copies of at least four individual student artifacts which reflect the assignments utilized for meeting each of the three learning goals, although copies of all artifacts are preferable.

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. A minimum of four student artifacts are requested, although it is likely that 2 of those will be randomly selected for the assessment to keep the assessment impartial.

## 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.

Each year, faculty gather an assortment of artifacts from their courses that measure student learning with respect to the above goals, along with a rubric that describes how the learning has been assessed. These artifacts will be 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.

Based upon an assessment of departmental SIR data, the faculty are meeting the needs of the students and are rated as GREEN.

Based upon assessment of course syllabi, the learning goals are not always well-displayed nor are assignments delineated as meeting those learning goals. For the inclusion of course learning goals, the syllabi are rated as 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. This is still an issue that is not being covered fully by all courses, thus the faculty assignments receive a rating of YELLOW. Student artifacts which were submitted for those assignments, however, receive a rating of GREEN.

Learning Goal 3 – Like goal 2, this learning goal was assessed in AY 2006-07 as yellow. 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.

For the 2010-2011 AY, the departments rate student learning for all three learning goals as a tentative GREEN. While we are pleased with this rating, the Natural Science faculty recognize that the assessment is not complete unless all courses are equally analyzed, and we will continue to work on ways to ensure that all our students perform at the "green light" level in the future.

Respectfully submitted by Dr. Jennifer R. Schultz-Norton, on 7/1/11.