Student Learning in “Natural Science with a Laboratory Experience” Courses

Self-Study Report
Academic Year 2017-2018

Contents

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I. Executive Summary

The departments of Biology, Chemistry, and Physics have developed the following learning goals for courses students take to satisfy the Millikin Program of Student Learning (MPSL; the University's course distribution requirement for graduation) Natural Science with Lab Experience (NSLE) non-sequential course 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.

Accomplishing the NSLE goals will simultaneously address the core goals expressed in the mission statement of Millikin University. The first and third NSLE goals will help students achieve *professional success* through their practice of the scientific method as a mode of critical inquiry demanded by many careers. All three goals will contribute to Millikin graduates' working knowledge of issues, processes, and advances in science and technology around the globe, thus helping them contribute as *democratic citizens in a global environment*. By acquainting students with the nature of scientific investigation, how advances impact daily life, and the potential for facilitating future advances and changes, the NSLE second and third goals help *prepare students for a personal life of meaning and value*.

The courses students take to satisfy these learning goals come from the three departments in the natural sciences and are taught by a large majority of the full-time faculty in each department. Prior to 2011, the evaluations were limited to one course per department. From 2011-13, the assessments included evaluations of several courses per department, and assessments were based upon syllabi, assignments and rubrics, and student artifacts. Assessments from 2014-2017 expanded to include diversity (number of students in NSLE courses from each major) and an evaluation of SIR scores but rested on assumptions based on previous reports, lacked evaluations of syllabi for uniform statements of NSLE goals and methods to reach them, and did not analyze student artifacts to evaluate learning. This 2018 report is based on current data and includes evaluations of student artifacts from nine NSLE courses.

From 2011-13 our status on all three learning goals was awarded a "green light" (acceptable) according to results seen in assessment rubrics. An unanswered call for a new faculty assessor in 2013-14 prevented review of the learning goals and artifacts, but minimal changes to the courses and faculty who taught in science MPSL courses for AY 2013-14 as well as enrollment data supported a conclusion that the efforts to meet NSLE goals remained at a "green light" status. Because no new faculty assessor was named until early May, 2015 learning goals were not actively assessed, and reports since then lacked evaluations of student artifacts. Reports submitted in 2016 and 2017 were also incomplete especially in lacking evaluations of student artifacts, but they did provide data warranting continued award of a "green light" for the effectiveness of the program in reaching its learning goals. This report—for the first time since 2013—provides a complete analysis and has data on course and enrollment variety, design, student appreciation, faculty participation, and an evaluation of student artifacts. It concludes that the NSLE program is achieving its goals and deserves a "**green light**". The tardiness of the report and imperfections in the nature of the student artifacts provided for evaluation earns the assessment process itself a "**yellow light**", but the elements of a complete report are now in place and we have data that suggest how the evaluation of student artifacts might be improved next year.

II. Goals

The faculty in the Departments of Biology, Chemistry, and Physics design courses that satisfy the MPSL NSLE requirement to leave all Millikin graduates with the ability 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, and

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

Students who achieve these goals will simultaneously satisfy the core goals expressed in the mission statement of Millikin University. Specifically, a Millikin education aims to help students

1. *achieve professional success*, a goal supported by the NSLE requirement in helping students learn how the nature, application, and practice of the scientific method as a mode of inquiry is valuable as a way to approach questions found in any career,

2. *become a democratic citizen in a global environment*, a goal facilitated by NSLE courses in helping students learn about, contribute to, and form opinions on issues that challenge people either in particular regions or across the globe, and

3. *prepare students for a personal life of meaning and value*, a goal supported by NSLE courses in helping student connect the theory in texts to the practical applications of science in their lives and guiding students develop as life-long learners and continue to integrate future developments in science into their understanding of and participation in world events.

With a faculty assessor in place and suggestions made to improve the program provided in previous reports, these have been reviewed in detail during and at the conclusion of the 2017-18 academic year.

III. Snapshot

The departments of Biology, Chemistry, and Physics at Millikin University were staffed in 2017-18 by 18 full-time faculty (17 tenured/tenure-track faculty and one full-time instructor), nine part-time adjunct faculty, and 1.5 academic staff support personnel. A tenured biologist, C. Handler, teaches half-time while directing the Pre-Professional Program. Similarly, the full-time instructor, R. O'Conner, divides her duties between teaching and lab support (lab set-ups, inventory, ordering, etc.) in the biology department. Visiting professors in 2016-17 were replaced with tenure-track faculty this year. The science departments are housed in the Leighty-Tabor Science Center (LTSC). Opened in 2002, it meets all teaching and research needs of the natural science faculty. Full-time faculty teach a variety of courses designed for non-majors, service courses required by other programs (e.g., Nursing, Exercise Science), and entry- and upper-level science major courses. Adjunct faculty rarely serve as lead instructors; rather, they typically direct introductory course laboratory sections. Course sizes vary from as few as eight students (the enrollment needed for a class to run) and most classes are limited to no more than 20 students with exceptions being lecture sections in a few introductory-level classes that may reach up to 60 students. The few larger classes typically serve non-majors and include BI206/207 (*Human Anatomy and Physiology I/II*), CH203/205 (*Essentials of Organic and Biochemistry*), PY100/104 (*The Planets*) and PY101/105 (*Stars and Galaxies*). Labs in all classes are capped at 12-24 students depending on demand, resources, and course level.

This review covers NSLE courses offered in AY 2017-18 and focuses on courses for non-science majors, service courses required by other majors, and introductory courses for science majors. They include accelerated courses offered for PACE/FLEX non-traditional students. 16 of 18 (88.9%) full-time science faculty members and 22 of 26 all science faculty (84.6%) participated in NSLE course instruction.

IV. Learning Story

NSLE students typically fall into three groups: 1) science majors who take many science courses; 2) students who need required service courses, notably those majoring in Nursing and Exercise Science, and 3) non-science majors fulfilling the NSLE requirement and usually take only one or rarely more than a couple science courses. All NSLE courses must demonstrate that they meet NSLE learning objectives. In addition, courses for science majors and students in service courses have learning goals specified by the major and/or professional programs must also meet objectives defined by their major or dictated by outside professional programs. The combination of these three groups represent the entire student body, and the result is a highly diverse clientele for the NSLE courses.

The many and varied NSLE courses preclude describing a "typical" experience. Instructors use content delivery and inquiry-based pedagogical methods, and they integrate lectures and labs to emphasize critical thinking, application, and problem solving skills reflective of current teaching practices.

V. Assessment Method History

Before 2011. Early assessment efforts involved one faculty member from the Biology, Chemistry, and Physics departments to represent the diversity of NSLE courses. These instructors assessed one of their own courses, and their individual evaluations were combined to produce the overall NSLE assessment. This method underrepresented the breadth of NSLE courses and missed much of the variety of science courses. As listed in Table 1, many courses meet the NSLE requirements (27 in 2017-18) and several were offered more than once each year; evaluating a single course from three instructors seemed insufficient. Also, a rigorous and impartial assessment cannot be conducted only by instructors evaluating their own courses, so an impartial evaluator seemed necessary.

2011-13. Student course evaluation (SIR) scores, a syllabus audit, and rubric-guided evaluations of course syllabi and faculty and student artifacts were used to determine success in meeting the NSLE assessment goals as described in 2011-13 NSLE assessment reports. The SIR data were not specific to NSLE courses and instead rated all courses taught in the three departments, and while illustrating the satisfaction of students with science classes in general, they did not speak to NSLE goals, are of questionable relevance, and were omitted in subsequent reports. Faculty syllabi for NSLE courses contained information explicitly required by the University but were very weak in expressing NSLE goals. Rubric-guided evaluations of artifacts submitted by faculty (e.g., tests, assignments) and students (e.g., papers, worksheets) showed improvement in faculty efforts to evaluate success in reaching NSLE goals and in student work directed to the goals. The evaluation process was time-consuming and did not involve all NSLE faculty or courses, but did document success in meeting the goals of expanding faculty participation and including a larger variety of NSLE courses. A larger subset of courses was assessed annually for AY 2011-13, with the goal of having 60-70% faculty contribute course assessments from biology and chemistry and 100% participation from physics (see Table 3). The increased participation produced a wider variety of artifacts and supported a conclusion that NSLE goals were being met across the range of these courses.

2013-15. The NSLE assessment system broke down in 2013-15. The NSLE assessment coordinator was not replaced after AY 2012-13; consequently, no data were collected. The 2013-14 report is based on a meta-analysis of available information and concluded that, with little change in classes and faculty that year, NSLE courses merited "**green light**" status in meeting all three NSLE goals. Failure to secure an NSLE assessment coordinator until May 2015 meant that again no data were requested or collected during AY 2014-15. There was too little time to obtain and evaluate course enrollment data, NSLE-specific SIR data evaluations, artifacts, and audit syllabi for NSLE goals statements. Example: requests of administrative offices for SIR and enrollment information at the end of the spring semester were not answered. Again, analysis of data that were widely available and lack of substantial change to the NSLE program warranted a "**green light**" conclusion regarding program goals and suggestions for improving assessment in the coming year.

2014-2017. Incremental changes were made for the 2014-15, 2015-16, and 2016-17 reports. All syllabi for NSLE courses were required to include specific language including the learning goals statement and how the course would achieve the goals (2015), Information Technology provided enrollment figures for Table 2 to allow it to be updated for all previous years (2016), and NSLE-focused SIR data were provided and compared against those from other University cohorts (2017). No student artifacts were gathered or even requested for direct evidence of student learning or appreciation for the role of science and scientific investigation in society. The program again received a "**green light**" while the assessment process rose to "**yellow light**" status due to the lack of artifacts and evaluations (and that was probably generous…).

VI. <u>Current practice and results</u>. A complete NSLE assessment report should have six elements, all of which are now provided in this report.

1. A list of all courses, faculty, and enrollments summarizing the previous year's offerings. *Comments: Table 1 illustrates a wide diversity of offerings, broad participation by Natural Science faculty, efficient use of resources, and hands-on exposure of Millikin students to scientific inquiry.*

2. Evidence of the diversity of student exposure to NSLE courses. *Comments: Table 2 shows that NSLE courses enrolled students from almost every major in each of the past seven years. Trends: science majors take the most NSLE classes (many of which are either introductory or co-requisite courses in their major), students in majors that require science courses (e.g., Nursing and Athletic Training) are heavily represented, and students in majors not directly related to science take NSLE classes at a lower rate. This is as expected given student interests and curricular requirements; bottom line: students from all disciplines take NSLE courses.*

3. Verification of attention by faculty to NSLE learning goals in every class that meets this MPSL requirement. This is done by an audit of NSLE class syllabi. *Comments: Of 62 NSLE syllabi evaluated, 98% (all but one) have the required statement of the NSLE learning goals. 30 of the 62 syllabi lacked a statement of how the goals would be achieved during the class and only 2 syllabi explained how the NSLE goals would be assessed. The latter is not surprising because the need to do this has not been emphasized over the past several years. Syllabi have other minor issues, none of which impact the NSLE goals. See Appendix I for the syllabus evaluation rubric and Table 3 for data.*

4. Indication of student satisfaction with the NSLE offerings. This is done by comparing student course evaluations (SIRs) for NSLE courses with those of courses offered by other university cohorts including those of the combined MPSL courses, and all courses offered in the natural sciences, the Division of Natural Science and Mathematics, the College of Arts and Sciences, and Millikin University as a whole. *Comments: Table 4 details the SIR score averages for NSLE, all natural science, Natural Science and Math Division, College of Arts and Sciences, and Millikin University courses in the fall and spring semesters of 2017-18. As explained on the table, detailed comparisons were not attempted due to the lack of access to individual SIR replies from all courses. SIR averages in the spring appear at first glance to be considerably lower than for other cohorts and vs. fall values, but removing scores from courses taught by an inexperienced (first semester) instructor increased the scores by an average of 0.35 points for every question and results were comparable to all cohorts. NSLE course students agreed with every SIR statement; none were rated below 4.28 in the fall or below 3.76 (4.00 by omitting the new instructor) in the spring, and most were higher. So, NSLE SIR averages were not appreciably different than those of larger comparison groups. Interestingly, NSLE scores were consistently higher than those of the comparison groups in the fall and lower in spring even when adjusted for the inexperienced instructor. While this makes for interesting speculation, no more detailed comparisons can be made given the data provided for this report.*

5. Evidence of participation by faculty in the assessment process. *Comments: While the assessment coordinator composed the report in its entirety, other faculty contributed by providing student papers for direct assessment of student learning. This is the first time since 2013-14 that faculty were asked to contribute materials for evaluation. It must be noted that artifacts were collected only during the spring semester. Also, the call for artifacts came at the end of the semester, so faculty could not develop written assignment(s) intended for an NSLE assessment and instead submitted assignments that they believed best reflected the NSLE learning goals in part or whole. Faculty from courses without suitable assignments were invited not to participate, and this may explain the lower participation rates. See Table 5 for the history of faculty participation.*

6. Evaluation of student work with regard to the NSLE learning goals. *Comments: 29 papers chosen out of the 82 student artifacts submitted from nine courses were evaluated for their demonstration of success in achieving the NSLE learning goals. Instructors chose a class assignment they felt best illustrated achievement of the NSLE learning goals and directed students to submit their papers to a Moodle page during the last week of the spring semester. Assignments received fell into three groups: topical essays (literature reviews), lab reports based on class experiments, and short answer—multiple choice activities focused on a particular topic. As might be expected, the collection of papers incompletely addressed the learning goals, but they suggested what might work best. Table 6 shows that the combination of all papers demonstrated understanding of the scientific method, but no other question on the rubric yielded an average score above 3.7. Grouping the papers into the nature of the assignments suggests why this is so. Topical essays (e.g., a literature-based essay on cholera) showed good understanding of the subject topic of the assignment, some understanding of the scientific method, but no use of technology in the lab or field. Laboratory reports produced very good scores for use and understanding of the scientific method and applications of technology but poorly showed connections of science beyond the experiment itself. Guided assignments (short answer or objective answers to specific questions) produced weak scores in all categories, especially in use of technology. These scores would have no doubt improved if faculty were able to design the assignments for this assessment, but it is hard to see how any literature-based report or question-answer form on specific topics could allow students to* <u>*demonstrate*</u> *use of technology, nor would an experiment-focused lab report inherently prompt students to reflect on the personal or global impact of their experiment. Given the data in Table 6, a laboratory report that requires students to explain the experiment's history, context, and broader applicability in the Introduction and Discussion sections of the paper should reveal learning in all three learning goals.*

This 2017-18 report now includes all of the agreed upon assessment methods, albeit with improvement needed in artifact evaluation. Given what is now in place, it is reasonable to conclude that

1. All Millikin students are exposed to formal science education in classes that demonstrate the scientific method through hands-on, experiential methods. Table 1 shows the variety of courses offered to meet the requirement while Table 2 illustrates the diversity of students who enroll in the classes as described by their major.

2. As verified by a syllabus audit (Table 3), all but one of the NSLE classes include in their syllabi a list of the goals of the NSLE graduation requirement, but only half of the syllabi included descriptions of how those goals would be met and only two of 62 syllabi attempted to describe how the NSLE goals would be assessed.

3. Students appreciate the quality of instruction and lessons of these courses to the same degree as of all other university classes as verified by their positive responses on SIR surveys (Table 4).

4. Faculty willingly contribute student work to the assessment process and faculty participation by that standard increased to half of those who teach NSLE course even after a late call for papers that provided only vague guidelines on what was needed (Table 5).

5. Assessment of student artifacts imperfectly demonstrated student learning when the assignment design and style is not well-defined. Assignments used this year were not designed with an intentional focus on the NSLE learning goals, and none met all of the needs of an assessment of all of the NSLE learning goals (Table 6).

So, after several years of incomplete assessment reports, improving syllabi and better organizing, advertising, and evaluating student artifacts remain on the “to do” list. Given the willingness of faculty to contribute student work despite an admittedly tardy and uninformative request, there should be little problem developing a better tool in the future.

VI. <u>Trends and Improvement Plans</u>

Changes in the NSLE assessment effort at the beginning of AY 2011-12 improved faculty participation and expanded the diversity of courses included in the final NSLE assessment report. An appreciation of the stability in faculty and curriculum and lack of audible calls for change during 2013-17 support the conclusion that these goals have been well met during the absence of an active assessment effort. With this report assessment efforts have evaluated student artifacts to suggest what might best be used in the future to provide tangible evidence of student learning.

<u>Current State and Future Prospects</u>. The NSLE element of the MPSL has not been significantly altered in recent history primarily because, given the decision of the University faculty to restrict the science graduation requirement to a single course, students and teachers appear to be happy with our current offerings. There have been no calls to change the program, most likely because it allows each department to contribute as it sees fit and permits individual faculty to design courses for non-majors with topics that capture the expertise and enthusiasm of the instructor. Given the overall satisfaction and success of NSLE offerings and barring a significant revision of the MPSL program, there is little reason or need to change our approach to meeting the NSLE requirement.

This conclusion relies on assumptions as well as concrete data, so it did not meet the requirements that an effective assessment mechanism must include broad faculty participation, reliable annual data, and first-hand evidence of student learning. To improve the process, the 2016-17 annual NSLE assessment report suggested that efforts should be made to boost faculty participation in the assessment process beyond the efforts of one assessment coordinator, and that half of the full-time science faculty submitted student artifacts for evaluation shows this was at least partially accomplished. That report also called for evaluation of those student artifacts, and that was accomplished in a way that imperfectly but directly assessed student learning as well as evidence for how this might be done more effectively in the future.

Two improvements in the assessment process made this year produced partially satisfactory results. Faculty participation increased to half of the NSLE faculty after a late and poorly described request for student artifacts. A detailed request made at the beginning of the semester should allow more (and, ideally, all) NSLE faculty to contribute useful artifacts in the coming year. And with better directions that describe what type of artifact works best (i.e., a lab report that includes a requirement to relate the experiment and its results to their relationship to the student and world around them), assessment of actual student learning should produce much better results than was seen this year. Also, as noted above, attention must be paid to how course syllabi articulate the NSLE learning goals

Needs for improvement and goals.

1. Course syllabi need to state not only what the NSLE learning goals are but also how they will be achieved by and assessed in the course and during the annual NSLE assessment process. Goal: more clearly describe syllabus requirements to all faculty at least a week before school starts to yield 100% compliance of syllabi with this requirement.

2. Faculty need earlier notification and more detailed instructions of what is needed of student artifacts to assess student learning and success in meeting the learning goals. Goal: distribution of instructions to faculty at least one week prior to the beginning of classes each semester detailing the requirements for useful student artifacts and how they need to be submitted with a goal of receiving comparable and useful artifacts from every NSLE course.

3. Agreement on what is needed for an assignment that will be used for artifact evaluation. The suggestion from this year's evaluation—a lab report with augmented commentary on personal and global impacts—must be formalized and discussed by the biology, chemistry, and physics faculty. Goal: complete this process by mid-fall semester of 2018.

VII. Conclusion

All evidence supports the following conclusion: Every Millikin student graduates with at least one experience in experimental science that helps them not only to *do* the scientific method but also to understand the impact of properly interpreted data on individuals, the greater population, and the environment. While the assessment process may need tweaking in artifact collection to produce clear data from every NSLE course on student learning related to the NSLE learning goals, this evaluation must conclude that the current NSLE requirement meets its stated goals.

Respectfully submitted by Jeffrey A. Hughes, Professor, Department of Biology and NSLE Assessment Coordinator, 8/26/2018.

Table 1. "Natural Science with Laboratory Experience" courses with enrollments

Course Number	Course Title or Section Name	Sect'ns '17-'18	Sem(s) Offered	Seats	Enrolled	Instructor(s)
BI102	*Behav. Tax. Spiders*	1	S	20	18	Robertson
	Biochem. of Food	2	F,P	62	60	Galewsky
	Biology of Birds	2	F,S	40	33	Horn
	Biology Inf. Disease	1	F	20	19	Zimmerman
	Biology of Spiders	1	S	16	16	Robertson
	Curr. Issues in Bio.	1	S	20	20	O'Conner
	Hormones & Society	1	S/P	25	25	Schroeder
	Human Biology	1	S	20	20	Smith
	Plants, People, Culture	1	F	25	17	Parrish
BI105/155	*Ecol. & Evol'n + Lab*	3/6	F	75	62	O'Conner, Parrish, Robertson, Smith, Wilcoxen
BI108/158	*Diversity Life + Lab*	2/3	S	60	55	Schroeder, Parrish, Smith
BI125	*Local Flora*	1	S	18	18	Parrish
BI130	*Environ. Biology*	1	F	20	14	O'Conner
BI204	*Ess. of Anat. & Phys.*	3	F,S	64	50	Handler, Smith
BI206	*Human Anat./Phys. I*	3	F,S	97	66	Smith, Zimmerman
BI207	*Human Anat./Phys. II*	2	F,S	80	48	Wilcoxen, Handler
BI230	*Prin. of Microbiology*	2	F,S	60	53	Hughes
CH114	*Fund. of Chemistry*	3/5	F,S	112	107	Barnes, Kok, Guasco, Hadsall, Higgins
CH121/151	*Gen. Chemistry*	2/4	F	70	57	Barnes, Guasco, Knust
PY100/104	*The Planets*	1	S	50	34	Watson, Olson
PY101/105	*Stars and Galaxies*	2	F,S/P	76	60	Watson, Werner
PY111/171[#]	*College Physics I*	1/2	F	36	21	Watson, Guasco, Barnes
PY112/172[#]	*College Physics II*	1	S	25	23	Biswas, Manna
PY151/171[#]	*University Physics I*	1	F	26	22	Watson, Guasco, Barnes
PY152/172[#]	*University Physics II*	1	S	25	21	Biswas, Manna

TOTALS: 18 courses, 27 classes, 36 sections, 1177 available seats, 965 students enrolled (82.0% of capacity).

F = Fall, S = Spring, Su = Summer, P = PACE (fall or spring)

Courses listed as a single number have labs integrated with lectures, courses listed as ###/### have the lecture course listed before the obligatory laboratory course. Every course carries four credit hours.

[#]PY171/172 enroll students from College and University Physics; there were two sections of each lab.

Table 2. Distribution of students taking NSLE courses by major. This includes the number of students who enrolled in at least one NSLE course during the fall and spring semesters. For instance, if a student enrolled in two NSLE courses in a single semester it would count as one student, not two enrollments. If a student enrolled in one NSLE course in the fall and another in the spring semester it would count as two courses.

Major	**'11-'12**	**'12-'13**	**'13-'14**	**'14-'15**	**'15-'16**	**'16-'17**	**'17-'18**
Accounting	21	12	12	12	10	4	6
Art	2	2	4	2	0	0	2
Art Education	1	1	0	0	0	2	1
Art Therapy	7	2	2	4	4	2	5
Athletic Training	26	27	47	61	56	65	1
Bio. (all tracks)	12	17	25	16	21	16	4
Bio., Sec. Tch.	10	4	9	9	9	4	38
Bus./Bus. Und..	18	15	11	7	9	3	138
Chemistry	27	39	75	38	31	29	6
Chem., Sec. Ed	3	0	0	1	5	2	5
Commercial Art	1	13	0	0	0	0	36
Comm.l Music	18	49	7	10	13	11	1
Communication	25	15	43	41	41	36	0
Digital Media	NA	NA	NA	0	1	5	15
Early Child. Ed.	19	25	16	7	7	7	26
Elementary Ed.	25	1	29	19	14	15	9
English – Lit.	1	4	1	1	2	1	12
Engl., Sec. Ed	6	11	5	3	4	3	25
Engl. - Writing	7	6	4	1	2	5	0
Env. Studies	0	0	0	0	0	2	1
Entrepreneurship	2	36	1	7	5	1	4
Expl. Stud./Und.	23	6	39	30	41	49	6
Finance	3	28	7	1	0	0	1
Graphic Design	1	20	2	3	3	3	30
H.F.R (& F.S.)	57	1	37	29	31	42	0
History	5	8	1	1	0	0	5
Human Services	23	26	33	17	24	20	37
Info. Systems	3	1	11	3	3	3	0
Info. Tech.	0	0	0	1	1	0	12
Instruct. Devel.	0	0	0	0	0	1	3

Major	**'11-'12**	**'12-'13**	**'13-'14**	**'14-'15**	**'15-'16**	**'16-'17**	**'17-'18**
Interdepartmen'l	6	2	0	2	3	1	0
Intern'l Bus.	3	1	0	1	2	2	3
Intern'l Studies	2	0	2	0	0	0	0
Management	0	0	0	6	8	7	11
Marketing	6	9	7	7	2	3	3
Math/App. Math	4	9	4	3	7	5	6
Math, Sec. Ed.	5	2	3	4	7	10	8
Math, Act. Sci.	3	3	0	2	3	4	4
Music	4	13	2	7	3	5	6
Music Business	8	14	10	11	10	14	9
Music Ed Inst.	2	6	3	2	1	3	3
Music Ed Vocal	11	12	10	10	8	9	6
Music Perf. Inst.	3	6	5	2	1	4	5
Music Perf.-Voc	11	2	4	4	4	3	1
Musical Theatre	11	4	6	11	8	11	21
Non-Deg/Undec	2	0	6	2	3	3	2
Nursing/Pre-Nrs	49	81	182	143	142	16	11
Org. Leadership	0	0	0	0	0	26	40
Philosophy	4	5	5	6	4	2	2
Phys Ed (K-12)	27	25	13	9	8	8	6
Physics	10	16	32	10	11	7	9
Pol. Science	0	4	6	5	3	1	2
Psychology	20	35	42	17	26	28	27
SocSci. Sec. Ed	0	3	13	1	3	4	5
Sociology	13	16	5	12	11	15	17
Spanish	3	1	0	4	5	6	7
Sport Mgt	1	22	22	29	34	32	45
Studio Art	6	9	5	3	3	1	3
Theatre	29	23	14	33	34	24	28
SUM	**700**	**848**	**105**	**820**	**887**	**88**	**82**

Includes BI102, BI105/155, BI108/158, BI125, BI130, BI204, BI206, BI207, BI230, BI280, CH121/151, CH131, PY100/104, PY101/105, PY111/171, PY112/172, PY151/171, PY152/172. PACE and accelerated classes were included beginning 2014-2015.

Table 3. Evaluation of NSLE syllabi. Syllabi for all 2017-18 courses (n = 62) were evaluated using a nine-item rubric for required information. Each item was scored either "'2" (acceptable), "1" (present but needs improvement), or "0" (omitted). The average for each group was calculated without regard for course credits or whether a lecture or laboratory section.

Category	Item	% included	Average score	Explanation for Deficiency
Course Information	Course ID	100	2	All syllabi contained the required information
	Faculty Information	100	2	All syllabi contained the required information
	Course Description	100	1.74	Course description that clearly explained subject matter not included
	Learning Goals	87 (54/62)	1.82	Learning goals omitted or not directed to the course specifically
Course Mechanics	Grading Policy Clear	100	2	All syllabi contained the required information
	Attendance policy present and explained	98 (61/62)	1.69	All syllabus mentioned attendance, some did not specify consequences
	MU *Academic Integrity Standards* statement included	100	2	All syllabi contained the required information
	MU *Disability Accommodation Policy* statement included	100	2	All syllabi contained the required information
	MU *Sexual Misconduct* statement included	74 (46/62)	1.65	The statement was omitted
NSLE Goals	NSLE goals present and described	98 (61/62)	1.45	All syllabi listed the goals but did not describe how they would be met
	How understanding of the scientific method will be assessed	3% (2/62)	0.05	Two syllabi of 62 total mentioned how success would be assessed
	How understanding of scientific issues personally & globally will be assessed	3% (2/62)	0.05	Two syllabi of 62 total mentioned how success would be assessed
	How use of technology in the field or lab will be assessed	3% (2/62)	0.05	Two syllabi of 62 total mentioned how success would be assessed

Table 4. SIR Average Comparisons, 2017-2018 Fall and Spring Semesters.

Fall 2017

SIR Questions	**NSLE**	Univ. Studies	vs. Univ. Studies	Science Only	Nat. Sci. & Math	Arts & Sci.	Millikin U.. (all)
Total Enrollment	**660**	1,261		1,203	1,671	5,013	11,939
# SIRs	**389**	569		607	786	2,102	4,578
% response	**59**	45	+14	50	47	42	38
Q1: Reasonable?	**4.49**	4.42	+0.07	4.38	4.45	4.44	4.47
Q2: Prepared?	**4.73**	4.52	+0.21	4.63	4.67	4.57	4.55
Q3: Organized?	**4.57**	4.39	+0.18	4.43	4.51	4.42	4.42
Q4: Time used well?	**4.64**	4.37	+0.27	4.53	4.57	4.44	4.43
Q5: Grades?	**4.28**	4.27	+0.01	4.15	4.24	4.24	4.29
Q6: Command?	**4.70**	4.49	+0.21	4.61	4.64	4.56	4.59
Q7: Clear?	**4.50**	4.38	+0.12	4.36	4.44	4.40	4.41
Q8: Important Points?	**4.49**	4.44	+0.05	4.38	4.45	4.44	4.45
Q9: Examples?	**4.61**	4.51	+0.10	4.48	4.54	4.51	4.52
Q10: Questions?	**4.68**	4.39	+0.29	4.64	4.64	4.50	4.52
Q11: Enthusiasm?	**4.71**	4.61	+0.10	4.64	4.69	4.63	4.64
Q12: Available?	**4.67**	4.48	+0.19	4.58	4.61	4.54	4.54
Q13: Instructor Excellent?	**4.61**	4.39	+0.22	4.47	4.54	4.45	4.46
Q14: Course Excellent?	**4.39**	4.20	+0.19	4.25	4.31	4.24	4.30
AVG. SIR SCORE	**4.58**	4.42	+0.16	4.47	4.52	4.46	4.47

Spring 2018

SIR Questions	NSLE	Univ. Studies	vs. Univ. Studies*	Science Only	Nat. Sci. & Math	Arts & Sci.	Millikin U.. (all)
Total Enrollment	**462**	654		1140	1516	4,457	10,586
# SIRs	**232**	241		530	646	1,662	3,768
% response	**50**	37	+13	46	43	37	36
Q1: Reasonable?	**4.27**	4.50	-0.23	4.24	4.29	4.43	4.45
Q2: Prepared?	**4.28**	4.62	-0.34	4.52	4.55	4.55	4.54
Q3: Organized?	**4.13**	4.46	-0.33	4.35	4.39	4.41	4.40
Q4: Time used well?	**4.19**	4.44	-0.25	4.44	4.45	4.44	4.41
Q5: Grades?	**3.76**	4.27	-0.51	3.98	4.01	4.20	4.25
Q6: Command?	**4.29**	4.53	-0.24	4.48	4.50	4.54	4.59
Q7: Clear?	**4.09**	4.44	-0.35	4.28	4.29	4.39	4.41
Q8: Important Points?	**4.00**	4.52	-0.52	4.27	4.30	4.41	4.44
Q9: Examples?	**4.18**	4.50	-0.32	4.37	4.39	4.47	4.49
Q10: Questions?	**4.16**	4.41	-0.25	4.51	4.51	4.49	4.51
Q11: Enthusiasm?	**4.26**	4.64	-0.38	4.51	4.53	4.59	4.26
Q12: Available?	**4.20**	4.54	-0.34	4.46	4.48	4.49	4.50
Q13: Instructor Excellent?	**3.99**	4.45	-0.46	4.27	4.31	4.41	4.44
Q14: Course Excellent?	**3.86**	4.30	-0.44	4.08	4.13	4.26	4.30
AVG. SIR SCORE	**4.12**	4.47	-0.35	4.34	4.37	4.43	4.43

Notes:

- Numbers for NSLE scores are the average per SIR submitted (sum of class SIR average X enrollment divided by total enrollment). They were not adjusted for course credits, so reviews from a one credit class carried the same weight as reviews from a four credit class.
- Reviews from uncredited lab sections were not included.
- * "vs. Univ. Studies" was simply calculated as NSLE avg – Univ. Studies avg, so positive values show higher NSLE scores and negative values show higher Univ. studies avgs.
- Spring 2018 NSLE scores average 0.35 points higher if sections taught by one instructor are omitted. They presumably reflect student reactions to an inexperienced (first-time) new faculty member. Without SIRs from those courses, the averages are trivially lower than those for other cohorts.
- Other than noting differences in NSLE vs. Univ. Studies scores, no attempt was made at a detailed comparative analysis since the methodology for NSLE and other averages may be different and lack of individual student SIR scores for all classes precluded statistical analysis.

Table 5. Evaluation of faculty participation in NSLE assessment activities, 2011-18. Data for 2011-14 summarize results presented in the 2014-15 NSLE assessment report. One artifact was requested from each class so the "NSLE Courses" count lecture and associated labs as a single course. **Green** is >60%, **yellow** is 50%-60%, **red** < 50%

Acad. Year	Biology NSLE Courses			Chemistry NSLE Courses			Physics NSLE Courses		
	Courses Assessed	Faculty Particip'n[#]	Score	Courses Assessed	Faculty Particip'n	Score	Courses Assessed	Faculty Particip'n	Score
11-12	7/21=33%	5/11=46%	**red**	4/8=50%	3/5=60%	**yellow**	4/6=67%	2/2=100%	**green**
12-13	14/26=54%	6/12=50%	**yellow**	5/8=63%	3/6=50%	**green**	2/9=22%	1/2=50%	**red**
13-14	11/31=36%	5/12=54%	**yellow**	5/12=42%	4/9=44%	**yellow**	4/9=44%	2/2=100%	**green**
14-17	No artifacts were requested								
17-18*	9/14=64%	7/11=64%	**green**	0/1=0%	0/3=0%	**red**	2/4=50%	1/2=50%	**yellow**

* Participation in 2017-18 limited to supplying student artifacts during the spring 2018 semester only.

[#] Includes only full-time faculty

Table 6. Artifact evaluation. Three artifacts from each of nine NSLE classes were selected at random and evaluated according to the rubric in Appendix II to assess success in meeting the NSLE goals at the end of the spring semester. Each question was graded on a 5 point scale as described in the rubric with “5” representing the learning goal was addressed satisfactorily , “3” as incompletely addressing the learning goal, “1” addressing the goal but unsatisfactorily, and “0” is did not address the learning goal at all.

Type of artifact*	Tested NSLE Goal											
	Logic and Scientific Method				Scientific Issues				Technology in Lab and Field			
	Understands Scientific Method	Analysis	Problem Solving	Average Goal Score	Understands Issue	Issue’s Relationship to Self	Issue’s Global Relevance	Average Goal Score	Use of Technol-ogy	Relates Theory to Experiment	Relates to Real World	Average Goal Score
All Artifacts (n=9)	3.6	3.7	3.4	3.6	4.5	2.3	1.4	2.7	1.7	2.2	1.0	1.6
Topical Essays (n=3)	3.7	4.3	3.7	3.9	5.0	3.4	2.8	3.7	0.0	0.0	0.0	0.0
Lab Reports (n=3)	4.3	4.3	5.0	4.5	4.8	0.6	0.0	1.8	5.0	4.8	2.6	4.1
Guided Exercise (n=3)	2.7	2.6	1.7	2.3	3.8	3.3	1.9	3.0	0.0	1.7	0.0	0.6

* Description of artifact assignment type:

- All artifacts: average value scores of 29 artifacts selected from 82 submitted
- Topical essays: assignment was to describe a specific topic; in essence, a literature review
- Laboratory reports: assignment involved describing and analyzing a lab or field experiment
- Guided exercises: assignment consisted of short answer or multiple choice questions on a theme

Appendix I. Syllabus evaluation rubric

Natural Science with a Laboratory Experience

Syllabus Audit Form

	Syllabus is acceptable on item (2 pts)	Syllabus has item included but not in acceptable form (1 pt)	Syllabus does not have item (0 pts)
TOP of FIRST PAGE: Course Identification: course number, course name, faculty, semester			
SOMEWHERE in SYLLABUS:			
Faculty contact info: name, office, office hours, office phone, email address			
Course description: Standard description plus faculty written course description/overview			
Standard course learning goals			
Instructor's grading policy - scale and weights for assignments & for the semester			
Instructor's attendance policy – penalties			
Academic honesty & integrity statement (standard)			
University disability accommodations statement (standard)			
University sexual misconduct statement (standard)			
Specification of a written assignment that will serve as Logic and the Scientific Method artifact for assessment purposes			
Specification of a written assignment that will serve as Scientific Issues artifact for assessment purposes			
Specification of a written assignment that will serve as Technology in the Lab and Field Environments artifact for assessment purposes			

Evaluation of Student Artifacts in Relation to the Learning Goals of the Natural Science with Lab Experience MPSL Requirement

Appendix II. Student artifact evaluation rubric

Class Number or Name: ______________________________________ **Instructor:** _______________ **Term** _______

Goal 1: Logic and the Scientific Method

Item	Criteria			Score
	Excellent (5 pts)	Adequate (3 pts)	Unsatisfactory (1 pt)	
Scientific Method	Clearly understands scientific method; developed and tested hypotheses; drew valid conclusions from results; understood meaning of "theory" in a scientific context.	Demonstrated basic understanding of the scientific method; understood parts of the experiment but didn't wrap them into a complete whole.	Did not appear to understand the scientific method; could not distinguish between a theory and a guess.	
Analysis	Analyzed data and explained results; understood results and drew appropriate and justifiable conclusions; comparison with previous results or expectations reflected in discussion.	Basic data analysis; some conclusions not well supported; incomplete comparisons with previous results or expectations.	Inadequate data analysis; results not understood or compared with previous results or expectations.	
Problem Solving	Used logic and reasoning to solve problems; problem broken into components reflecting prior knowledge; information combined in a useful way; results interpreted accurately and compared with expectations.	Demonstrated basic problem solving ability; logic occasionally faulty; showed difficulties in dealing with complex problems.	Did not show the ability to solve problems beyond the most basic level.	

Goal 2: Scientific Issues

Item	Criteria			Score
	Excellent (5 pts)	Adequate (3 pts)	Unsatisfactory (1 pt)	
Understanding of issue	Showed understanding of a scientific issue; explained scientific principles governing the relevant science.	Incompletely understood the scientific issue; explanation unclear in parts; scientific principles not well understood.	Demonstrated weak understanding; did not explain scientific principles.	
Understanding of personal relevance	Clearly understands personal impact of a scientific issue; described how their actions impact causes and effects related to the issue and its long-term impact on their lives.	Demonstrated incomplete understanding of how a scientific issue affects them personally; may not understand their relationship to causes or effects.	Did not draw connections between the scientific issue and their own life.	
Understanding of global relevance	Understands how a scientific issue affects the world; connected political, social, or cultural causes and effects; understands future global impact.	Limited understanding of how a scientific issue affects the global community; did not draw connections to causes and effects.	Student unable to draw connections between scientific issue and other global issues.	

Goal 3: Technology in Lab and Field Environments

Item	Criteria			Score
	Excellent (5 pts)	Adequate (3 pts)	Unsatisfactory (1 pt)	
Use of technology	Used appropriate technology to acquire and analyze experimental data; used equipment safely and efficiently.	Used technology to acquire or analyze data, both. May be inefficient, but uses equipment safely.	Did not use appropriate technology to obtain take or analyze data; did not employ safe lab/field practice.	
Connection of theory & experiment	Connected data with expectations from class or texts; connected theory with practice; used results to discuss theory.	Incomplete demonstration of how theoretical expectations related to data.	Did not connect results obtained experimentally with expected results from class or texts.	
Connection to real-world phenomena	Lab/field results generalized to real-world events, discussed limits when comparing to the natural environment.	Incomplete link of lab/field results with real-world events; may not understand implications beyond lab/field.	Did not generalize lab/field results to real-world phenomena; did not discuss implications beyond lab/field.	

FINAL SCORE (sum of scores listed above) ______