

Name of Program/Department:	Department of Biology
Year:	2018 - 2019
Name of Preparer:	Ann Stoeckmann, Ph.D. and Jeremy Rentsch Ph.D.

Biology Department Mission

The mission of the Department of Biology is to produce scientifically literate graduates who display robust knowledge of biological principles from molecules to ecosystems. We train our undergraduate students to use their critical thinking skills and mastery of biological principles to perform inquiry into the biological world and effectively convey biological information. We are committed to experiential learning including laboratory, field, and research experiences. Students graduating from this program will be well prepared for a variety of professional careers or entry into graduate school programs.

Program Learning Outcomes:

The Biology Department prepares students who:

1. understand major concepts in the biological sciences.
2. think critically and apply scientific principles to reach conclusions.
3. use the scientific approach.
4. communicate cogently.

Executive Summary of Report

Presented in this report are the Biology Department's Mission, Program and Student Learning Outcomes, the assessment and results of each, and action items.

Achievement of our senior biology majors on concept knowledge and critical thinking skills (SLO 1 and 2) was assessed with a cumulative exam administered in our Senior Seminar courses both semesters. In spring 2019 the common Biology Exit Exam was examined for reliability and question quality and 10 of the 50 questions were replaced or wording was revised. The overall mean on the exam (58%) did not meet the benchmark (59%) nor did achievement in the separate areas of content (SLO 1: 59%) or critical thinking (SLO 2: 57%). However, the year's average increased slightly from last year and achievement in the separate areas remained the same this year. In the fall 2018 semester the department examined the previous year's results by concept area and determined that more concepts in the core areas of Genetics and Evolution, Plant Biology, and Ecology needed to be reinforced in the appropriate courses. The faculty enhanced their instruction in these areas by devoting additional time in lecture or lab to review. Student performance improved in Plant Biology and Ecology and met the benchmark in Ecology. However, exit exam results did not improve in the areas of Genetics and Evolution nor in Cell and Molecular. In order to get a better understanding of the level of achievement at which Francis Marion University biology majors begin the major curriculum, we also administered the Senior Exit Exam to students enrolled in the first course in the biology major. Although not the same cohort of students, the overall exam averages showed that students begin the major with an average achievement of 38.3% and by the time they are seniors they increase their achievement to 58%. The Biology Department is in the process of examining the 2018-2019 results by core area to determine where instruction needs to be enhanced to improve performance and are also investigating ways to improve our assessment methods for 2019-2020.

The Biology Department measured student achievement on use of the scientific approach and communication through student research project presentations (SLO 3 and 4). The department used the rubric they developed as a more objective "direct measure" of Biology majors' competence in the application and communication of the scientific approach in the Spring semester to evaluate student research presentations at our research symposiums (RED and PURE). The average proportion of students that achieved our goal score of 3.5 or greater in RED presentations met the benchmark of 35% in the overall average and in 2 of the 3 hybrid categories and increased 5% from last year's (baseline 31%). Although the proportion of PURE students that scored 3.5 or greater did not meet the benchmark of 35% the proportion of students exceeded the benchmark in Scientific Thought and Communication categories. The department is modifying the rubric and developing additional rubrics for use evaluating other types of student activities that incorporate the use of the scientific approach and communication in 2019-2020.

The Biology Department developed indirect assessment of all SLO's (*Attitude Survey*) was administered to 96% of graduating seniors in Spring 2019. At least 80% or more of students responded "strongly agree" or "agree" for the majority of questions (87%). Because this is the first year of the survey there is no baseline and the benchmark and target are being set.

Student Learning Outcomes

SLO 1.0: Biology majors will identify key concepts in the core areas of Plant Biology, Ecology, Cell and Molecular Biology, Genetics and Evolution at:

Baseline (last year's results) of 57%, Benchmark of 59%, Target (3 year) of 62%

SLO 2.0: Biology majors will demonstrate competence in critical thinking and the application of the scientific approach at:

Baseline (last year's results) of 57%, Benchmark of 59%, Target (3 year) of 62%

SLO 3.0: Students will explain and demonstrate how to 1) ask a question, 2) generate a credible literature review, 3) generate hypotheses, 4) execute hypothesis testing procedures, 5) organize and analyze data or information, 6) draw conclusions, and 7) produce a report to cogently communicate results at or above a score of 3.5. The proportion of students that achieve a score of 3.5: Baseline (last year's results) of 31%, Benchmark of 35%, Target (5 year) of 40%.

SLO 4.0: Students will cogently communicate cogently about biology at or above a score of 3.5. The proportion of students that achieve a score of 3.5: Baseline (last year's results) of 31%, Benchmark of 35%, Target (5 year) of 40%.

Assessment Methods

Student Learning Outcomes 1 and 2:

SLO 1.0: Biology majors will identify key concepts in the core areas of Plant Biology, Ecology, Cell and Molecular Biology, Genetics and Evolution at an overall average of: Baseline (last year's results) of 57%, Benchmark of 59%, Target (3 year) of 62% as evaluated by the Biology Exit Exam.

SLO 2.0: Biology majors will demonstrate competence in critical thinking and the application of the scientific approach at an overall average of: Baseline (last year's results) of 57%, Benchmark of 59%, Target (3 year) of 62% as evaluated by the Biology Exit Exam.

Direct Assessment

Performance on student learning outcomes 1 and 2 utilized a cumulative exam-(multiple choice format). Historically, the exam has been administered to students in the Senior Seminar course but because students take that course in one of their last two semesters prior to graduation some students may not be currently enrolled in or have completed all their course work. To address this issue of timing of exam administration, we administer the exam only to students in the semester they are graduating. In the Fall 2018 Senior Seminar course, enrolled students that would not be graduating until Spring 2019 did not take the exam. We followed the same

procedure with the Spring 2019 Senior Seminar course. Graduating students that did not take the exam were contacted and arrangements made and they took the exam in Spring 2019.

The common Biology Exit Exam administered in Fall 2018 and prior semesters was examined for reliability and question quality. Individual exam item analysis results for spring 2018 were evaluated and 10 of the 50 questions with either very high or very low percentage correct combined with low point biserial results (an indication of the question difficulty and quality) were replaced or wording was revised. The revised exam was administered to the Spring 2019 graduating seniors. Therefore Spring 2019 results do not directly compare to results for Fall 2018 or previous semesters.

To get an indication of how students entering the biology major perform, the cumulative exam (non-revised version) was administered to those students in Biological Sciences I Laboratory (BIO 115L) who were taking the biology majors lecture and laboratory courses for the first time. This course is required of all biology majors. The exam was administered on the first laboratory class day within the first two weeks of the beginning of each semester (Fall 2018 and Spring 2019).

We regard the mean percent score of the exam results to be a reasonable indicator of student-success in meeting the learning outcomes. This year's benchmark is 59% or higher (baseline is last year's results: 57%, target is 62%).

For security the Biology Exit Exam is not provided in the appendix. Copies are available upon request to the department.

Student Learning Outcome 3 and 4:

SLO 3.0: Students will explain and demonstrate how to 1) ask a question, 2) generate a credible literature review, 3) generate hypotheses, 4) execute hypothesis testing procedures, 5) organize and analyze data or information, 6) draw conclusions, and 7) produce a report to cogently communicate results at or above a score of 3.5 for student presentations at RED and PURE as measured by a rubric developed by Biology Department used to evaluate student presentations. The proportion of students that met the score of 3.5: Baseline (last year's results) of 31%, Benchmark of 35%, Target (5 year) of 40%.

SLO 4.0: Students will communicate cogently about biology at or above a score of 3.5 for student presentations at RED and PURE as measured by a rubric developed by Biology Department used to evaluate student presentations. The proportion of students that met the score of 3.5: Baseline (last year's results) of 31%, Benchmark of 35%, Target (5 year) of 40%.

Direct Assessment

Students apply the process of science (SLO 3) and build communication skills (SLO 4) in courses in our Biology curriculum. There are opportunities to apply the process of science and to build communication skills with assignments and exercises in the laboratory portions of courses and through research projects outside of class. Students may complete independent research projects (SLO 3) and receive credit (e.g., Bio 497, Honor's Thesis) or they may take part in projects and not receive credit but receive a stipend (e.g., Biology Research Experience Program Fellows (BREP) that are supported by our INBRE grant and REAL, the University's quality enhancement program).

After completing their project students may write a report, a thesis, or a paper on their work or they may produce a poster or do an oral presentation (SLO 3 & 4). FMU has two venues on campus for presentations. One is PURE, the Biology Department's research symposium held once per semester. Another is the campus-wide Research and Exhibition Day held every spring.

To evaluate student competence in application and communication of the scientific approach, the Biology Department used a more objective "direct measure" of Biology majors' competence in the application and communication of the scientific approach. The rubric (Appendix 1) was used two times in the spring 2019 semester. It was used in evaluation of student projects presented as posters at the campus-wide Research and Exhibition Day and oral presentations at the department's PURE Symposium. Biology Department faculty not involved with the research spoke to each presenter and independently evaluated each RED poster (3 faculty) and PURE oral presentation (3 faculty) utilizing the evaluation rubric.

Because participation in RED and PURE is optional, we expect students to perform quite well on average. As such, we deem the proportion of students that achieve scores of 3.5 or greater out of 4.0 in all hybrid areas as our: Baseline (last year's results) of 31%, Benchmark of 35%, Target (5 year) of 40%.

SLO 1, 2, 3, and 4

Indirect Assessment: Attitude Survey

We developed a survey in Spring 2019 of student attitudes to indirectly assess our four SLO's. with questions to the Biology Exit Exam (questions are listed in results section Table 5). We administered the survey to graduating seniors in Spring 2019 this year and 96% of the students graduating in Spring 2019 completed the survey. Because this is the first year implementing this survey, we have no baseline for comparison, and benchmarks and targets are being set.

In addition to offering indirect assessment of our SLO's, survey results also provide data about our courses and program.

Assessment Results

Student Learning Outcomes 1 and 2:

SLO 1.0: Biology majors identified key concepts in the core areas of Plant Biology, Ecology, Cell and Molecular Biology, Genetics and Evolution at an overall average of 59% as measured by a common Biology Exit Exam. Since our benchmark was 59%, this target was achieved.

SLO 2.0: Biology majors demonstrated competence in critical thinking and the application of the scientific approach at the 57% level as evaluated by the Biology Exit Exam. Since our benchmark was 59%, this target was not achieved.

SLO 1&2: Baseline (last year's results) of 57%, Benchmark of 59%, Target (3 year) of 62 %

Tables 1 and 2 summarize the results for each learning outcome and include the questions in the exam that pertain to each learning outcome. Table 1 summarizes the results for the graduating seniors and includes the results from 2017-2018 for comparison. Table 2 summarizes the results for students entering the major (BIO 115L).

The overall mean on the exam (58%) did not meet the benchmark (59%). However, the year's average increased slightly from last year. Achievement this year in the separate area of content (SLO 1) increased about 1% and critical thinking (SLO 2) remained the same when compared to last year's results.

We separated out the results in the areas of Fundamentals (those questions that are broadly applicable to multiple areas of biology) and Animal Diversity this year. Results in Fundamentals averaged 72.9% this year and were well above the benchmark whereas Animal Diversity results fell below the benchmark.

In fall 2018 semester, the department examined the breakdown of 2017-2018 results by area. The breakdown of the results suggested a need to enhance instruction in the core areas of Genetics and Evolution, Plant Biology, and Ecology and the department worked to reinforce concepts in that area. More reinforcement was incorporated and student performance improved in Plant Biology and Ecology and met the benchmark in Ecology. However, student performance did not improve in the area of Genetics and Evolution nor in Cell and Molecular.

Overall results for seniors (Table 1) were 20% higher than the students entering the major (Table 2, BIO 115L) showing overall achievement by biology students by the time they are seniors.

Test reliability based on Kuder-Richardson Formula 20 results indicated that both versions of the Biology Exit Exam are good (Kuder-Richardson Formula 20 results greater than 0.5 are considered good for an in-house prepared exam; Fall 2018 version = 0.80, Spring 2019 version = 0.74).

Table 1. Summary of results of the cumulative exam given to graduating seniors in Fall 2018 and Spring 2019. Results from Spring 2018 are included for comparison. The exam was revised in Spring 2019 so direct comparison is not possible.

Learning Outcome	Assessment (Exam question that pertains to each learning outcome)		Results (Mean percent correct)			
	Fall 2018	Spring 2019	2017-2018	Fall 2018	Spring 2019	2018 - 2019
1. Biology majors will identify key concepts in the core areas of Plant Biology, Ecology, Cell and Molecular Biology, Genetics and Evolution at an overall average of 59% (benchmark) as measured by a common Biology Exit Exam.	Concepts: 1, 2, 5-7, 9, 10, 12, 14-17, 20-23, 26, 28, 32, 34-36, 41, 43, 47-49	Concepts: 1, 2, 5-7, 9, 10, 12, 14-17, 20-24, 26, 27, 34-36, 41, 43, 44, 47-49	57.8	60.2	57.9	59
a. Plant Biology	5, 16, 22, 27, 29, 31, 39, 47	5, 16, 22, 25, 27, 31, 39, 47	53.5	58	57.1	57.6
b. Ecology	3, 11, 12, 40, 44, 48	3, 12, 28, 29, 40, 44, 48	56.3	56	64.8	60.4
c. Cell and Molecular Biology	2, 7, 9, 10, 18, 20, 21, 25, 26, 28, 30, 32, 33, 36, 37, 41, 42, 49, 50	2, 7, 9, 10, 11, 18, 20, 21, 24, 26, 28, 30, 33, 36, 37, 41, 42, 49, 50	60.6	58.1	54.5	56.3
d. Genetics and Evolution	4, 13, 17, 23, 35, 38, 46	4, 13, 17, 23, 32, 35, 38, 46	53.2	51.4	52.8	52.1
e. Fundamentals	8, 15, 19, 24, 34, 43	8, 15, 19, 34, 43	66.7	72	73.7	72.9
f. Animal Diversity	1, 6, 14, 45	1, 6, 14, 45	46	55	45.2	50.1
2. Biology majors will demonstrate competence in critical thinking and the application of the scientific approach at an overall average of 59% (benchmark) as evaluated by the Biology Exit Exam.	3, 4, 8, 11, 13, 18, 19, 24, 25, 27, 29-31, 33, 37-40, 42, 44-46, 50	3, 4, 8, 11, 13, 18, 19, 25, 28-33, 37-40, 42, 45, 46, 50	56.9	56.2	58.2	57
Number of graduates				32	49	81
Number of students completed exam (% of graduating seniors)			61	25 (78%)	47 (96%)	72 (89%)
Overall Exam Mean			57.4	58.2	58	58

Table 2. Summary of results of the cumulative exam given to students in BIO 115L in Fall 2018 and Spring 2019 taking the course for the first time. Students were not given the revised Biology Exit exam.

Learning Outcome	Assessment (Exam question that pertains to each learning outcome)	Results (Mean percent correct)			
		2017-2018	Fall 2018	Spring 2019	2018 - 2019
1. Biology majors will identify key concepts in the core areas of Plant Biology, Ecology, Cell and Molecular Biology, Genetics and Evolution at an overall average of 59% (benchmark) as measured by a common Biology Exit Exam.	Concepts: 1, 2, 5-7, 9, 10, 12, 14-17, 20-23, 26, 28, 32, 34-36, 41, 43, 47-49	37.4	39	35.8	37.4
a. Plant Biology	5, 16, 22, 27, 29, 31, 39, 47	26.4	30.2	27.7	28.9
b. Ecology	3, 11, 12, 40, 44, 48	45.3	48.9	44.5	46.7
c. Cell and Molecular Biology	2, 7, 9, 10, 18, 20, 21, 25, 26, 28, 30, 32, 33,36, 37,41, 42, 49, 50	35.6	37.4	35.3	36.4
d. Genetics and Evolution	4, 13, 17, 23, 35, 38, 46	38.1	30.5	30.7	30.6
e. Fundamentals	8, 15, 19, 24, 34, 43	n/a	55.7	45	50
f. Animal Diversity	1,6, 14, 45	n/a	55	45.2	50.1
2. Biology majors will demonstrate competence in critical thinking and the application of the scientific approach at an overall average of 59% (benchmark) as evaluated by the Biology Exit Exam.	3, 4, 8, 11, 13, 18, 19, 24, 25, 27, 29-31, 33, 37-40, 42, 44-46, 50	38.6	41	37.6	39.3
Number of students completed exam		235	177	144	321
Overall Exam Mean		40	39.7	36.8	38.3

Several factors may be responsible for the exam mean results being below the benchmark. One issue is that some questions in both learning outcomes assessed by the exam may cover content from courses that the student may have completed early in their course progression or are based on material in a subject area that is not reinforced in subsequent upper level courses (e.g., plant biology and animal diversity (Biology 106)). In addition, results show that students performed better on the content-based questions (SLO 1) than they did on the critical thinking questions (SLO 2) but students did perform better on the critical thinking questions in the revised exam given in Spring 2019 than in Fall 2018. Critical thinking questions are expected to be more difficult. Additionally, poor performance on the critical thinking questions may be exacerbated if a critical thinking question combines content from an early course and is not reinforced later.

Student Learning Outcome 3 and 4:

SLO 3.0: Students will explain and demonstrate how to 1) ask a question, 2) generate a credible literature review, 3) generate hypotheses, 4) execute hypothesis testing procedures, 5) organize and analyze data or information, 6) draw conclusions, and 7) produce a report to cogently communicate results at or above a score of 3.5 for student presentations at RED and PURE as measured by a rubric developed by Biology Department used to evaluate student presentations with the proportion of students that met the score of 3.5 or above: Baseline (last year's results) of 31%, Benchmark of 35%, Target (5 year) of 40%). RED: The proportion of students that scored 3.5 or greater met the benchmark of 35% in the overall average and in 2 of the 3 hybrid categories. PURE: The proportion of students that scored 3.5 or greater did not achieve the benchmark of 35% in the overall average but did in 2 hybrid categories.

SLO 4.0: Students will communicate cogently about biology at or above a score of 3.5 for student presentations at RED and PURE and as measured by a rubric developed by Biology Department used to evaluate student presentations with the proportion of students that met the score of 3.5 or above: Baseline (last year's results) of 31%, Benchmark of 35%, Target (5 year) of 40%). RED: The proportion of students that scored 3.5 or greater met the benchmark of 35% in the overall average and in 2 of the 3 hybrid categories. PURE: The proportion of students that scored 3.5 or greater did not achieve the benchmark of 35% in the overall average but did in 2 hybrid categories.

A rubric developed by Biology Department was used to evaluate student presentations. It was used to evaluate poster presentations at Research and Exhibition Day (RED, Table 4) and oral presentations at PURE symposium (Table 5). Scoring results were averaged for questions that fit into the same broad category ("Hybrid").

Research Exhibition Day saw 11 biology students present their work at this campus-wide event. Francis Marion Biology faculty (3) not involved with the research, talked to each student presenter during the poster presentation and used the rubric to independently evaluate each poster. Those data are found below (Table 3).

Table 3: Aggregated Research Exhibition Day evaluations (n = number of faculty evaluators per poster, STD = Standard Deviation). Individual scoring results were averaged for evaluators and for questions that fit into the same broad category (“Hybrid”). Results from Spring 2018 are included for comparison.

Poster number	n	Hybrid Scientific Thought Score	STD	Hybrid Scientific Method Score	STD	Hybrid Communication Score	STD	Overall Average	STD
2	3	3.44	0.50	2.73	1.18	2.87	0.96	2.95	1.01
7	3	3.11	0.57	2.67	1.14	2.47	1.26	2.69	1.11
13	3	3.33	1.05	3.80	0.40	3.67	0.47	3.64	0.66
28	3	2.78	0.79	3.80	0.49	3.07	0.57	3.13	0.65
27	3	3.78	0.42	3.67	0.47	3.67	0.47	3.69	0.46
18	3	3.44	0.68	3.33	0.47	3.00	0.73	3.23	0.66
15	3	3.44	0.50	3.53	0.72	3.13	0.72	3.36	0.70
38	3	3.56	0.68	3.53	0.50	3.40	0.71	3.49	0.64
21	3	2.56	1.07	3.40	0.71	3.27	0.44	3.15	0.80
39	3	3.78	0.42	3.53	0.50	3.67	0.60	3.64	0.53
11	3	3.78	0.42	3.47	0.62	3.47	0.88	3.54	0.71
Average		3.36	0.64	3.41	0.65	3.24	0.71	3.32	0.72
(Average 2018)		(3.29)	(0.67)	(3.33)	(0.65)	(3.31)	(0.67)	(3.31)	
2019 students (%) with score of 3.5 or greater		36%		55%		27%		36%	
(2018 students (%) with score of 3.5 or greater)		(31%)		(38%)		(31%)		(31%)	

Although the average scores in each hybrid area and the overall average were below 3.5 score goal, they did all fall within one standard deviation of that score. The average proportion of students that scored 3.5 or greater met the benchmark of 35% in the overall average and in 2 of the 3 hybrid categories. The overall average proportion of students earning a score of 3.5 or greater increased 5% from last year’s baseline (31%). In addition, there was an increase in the proportion of students earning a score of 3.5 or greater in 2 of the 3 hybrid categories with a 17% increase in proportion of students in the hybrid category of Scientific Method.

At the spring 2019 P.U.R.E symposium, 3 biology students presented their faculty-mentored work by giving 12 minute oral presentations about their research. Three biology faculty evaluated each of these talks with the evaluation rubric developed by the department. Those data are found below (Table 4).

Table 4: P.U.R.E symposium evaluations (n = number of faculty evaluators per presentation, STD = Standard Deviation). Results from Spring 2018 are included for comparison.

Talk number	n	Hybrid Scientific Thought Score	STD	Hybrid Scientific Method Score	STD	Hybrid Communication Score	STD	Overall Average	STD
1	3	3.56	0.50	3.47	0.62	3.47	0.81	3.49	0.67
2	3	3.67	0.47	3.73	0.44	3.60	0.61	3.67	0.52
3	3	3.67	0.67	3.33	0.79	3.53	0.62	3.49	0.71
Average		3.63	0.54	3.51	0.62	3.53	0.68	3.55	0.64
(2018 average)		(3.41)	(0.66)	(3.61)	(0.59)	(3.62)	(0.55)	(3.55)	
2019 students (%) with score of 3.5 or greater		100%		33%		67%		33%	
(2018 students (%) with score of 3.5 or greater)		(60%)		(80%)		(80%)		(80%)	

Although the proportion of students that scored 3.5 or greater did not meet the benchmark (35%) the proportion of students exceeded the benchmark in Scientific Thought and Communication categories. In addition, they all fell within one standard deviation of the goal score. Only Scientific Thought improved over 2018 results.

The number of student presentations was lower this year (3 in 2019, 5 in 2018) and the number of evaluators was lower (3 in 2019, 7 in 2018) both of which may be partially responsible for the decrease in overall achievement and high standard deviations in the scores.

SLO 1, 2, 3, and 4

Indirect Assessment: Attitude Survey

We developed a survey of student attitudes in Spring 2019 about the biology SLOs and administered it to graduating seniors in Spring 2019 (46 students, 96% of graduating students). Because this is the first year of the survey there is no baseline and the benchmark and target are being set. In addition to offering indirect assessment of our SLO's, survey results also provide data about our courses and program.

Table 5: Attitude survey results (percentages) from 96% seniors graduating in Spring 2019 only. This is the first year of the survey so there is no baseline and benchmarks and targets are being set.

SLO	Question on the Attitude survey	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree	Total of Strongly Agree & Agree
1	Courses in biology have strengthened my understanding of biological concepts in:						
	a. Genetics and Evolution	47.8	43.5	8.7	0	0	91.3
	b. Cell and Molecular Biology	37	52.2	4.3	6.5	0	89.1
	c. Ecology	41.3	41.3	17.4	0	0	82.6
	d. Plant Biology	37	34.8	19.6	6.5	2.2	71.8
2, 3	I able to demonstrate the relationship between multiple variables by using statistical analysis.	28.3	43.5	15.2	10.9	0	71.8
3	I am able to identify a hypothesis or purpose of a study.	95.7	4.3	0	0	0	100
3, 4	I feel to prepared to write a comprehensive lab report.	71.7	17.4	8.7	2.2	0	89.1
3	I understand and can employ a range of laboratory techniques/methods to study biological processes.	65.2	28.3	6.5	0	0	93.5
3	I am able to identify primary sources.	67.4	28.3	4.3	0	0	95.7
3	I am able to use the correct citation methods in my work cited.	76.1	17.4	6.5	0	0	93.5
4	I can explain biological concepts to others.	56.5	34.8	8.7	0	0	91.3
2	Courses in Biology at FMU have strengthened my ability to think critically.	69.6	30.4	0	0	0	100
N/A	The Biology department at FMU offers a sufficient variety of courses.	56.5	37	2.2	4.3	0	93.5
N/A	The methods and skills I have mastered as a biology major at FMU will help me in my future pursuits.	65.2	28.3	6.5	0	0	93.5
N/A	It is important that the Biology department introduces students to various careers in biology.	87	6.5	4.3	2.2	0	93.5
	Total students: 46 (96% of students graduating Spring 2019)						

At least 80% or more of students responded “strongly agree” or “agree” for the majority of questions (87%). Students felt less strongly (72% “strongly agree” or “agree”) on two questions: “I am able to demonstrate the relationship between multiple variables by using statistical analysis” and “Courses in biology have strengthened my understanding of biological concepts in plant biology.”

This year’s data serves as a baseline for future comparisons.

Action Items

To address the concerns below we are developing an action plan to be implemented during the next academic year.

Student Learning Outcomes

SLO 1.0: Biology majors will identify key concepts in the core areas of Plant Biology, Ecology, Cell and Molecular Biology, Genetics and Evolution at:

Baseline (last year’s results) of 57%, Benchmark of 59%, Target (3 year) of 62%

SLO 2.0: Biology majors will demonstrate competence in critical thinking and the application of the scientific approach at:

Baseline (last year’s results) of 57%, Benchmark of 59%, Target (3 year) of 62%

SLO 1 and 2:

1. The program scheduled the administering and scoring of the Exit Exam to better assess students only in the semester in which they are graduating and so therefore would be taking or have taken all relevant course work. We administered the exam to only students in the semester in which they graduate. In Fall 2018, the exam was administered to only those students graduating at the end of Fall semester. Likewise, at the end of Spring 2019, the exam was administered only to those students graduating in Spring 2019. Any student who completed the Senior Seminar course in the Fall 2018 semester but will not graduate until spring and therefore did not take the exam in fall, was contacted and took the exam at the end of the Spring 2019 semester. This procedure was successful again this year with the majority of graduating students completing the exam and will be continued in the future.
2. The breakout of the 2017-2018 results into the four core areas showed that student achievement decreased the areas of Plant Biology, Ecology, and Genetics and Evolution. In Fall 2018, the Biology Program ensured that certain core principles and concepts in those areas were reinforced in upper level courses where this material is included in the 2018-2019 academic year (taught in 2018-2019 including but not limited to: Bio 105 and 106 Biological Sciences I and II, Bio 206 and 207 Flora, Bio 201 Conservation Biology, Bio 303 Plant Kingdom, Bio 307 Plant Anatomy/Physiology, Bio 308 Aquatic Ecology, Bio 317 Marine Ecology, Bio 320 Plant Evolution/Diversity, Bio 401 Genetics, Bio 409 Evolutionary Biology).

The breakout of the 2018-2019 results into the four core areas showed that student achievement decreased the areas of Genetics and Evolution and Cell and Molecular Biology. In Fall 2019, the Biology Department will ensure that certain core principles and concepts in those areas are reinforced in upper level courses where this material is included in the 2019-2020 academic year including but not limited to: Bio 105 and 106 Biological Sciences I and II, Bio 301 Cell Biology, Bio 302 Developmental Biology, Bio 407 Immunology, Bio 401 Genetics, Bio 409 Evolutionary Biology.

3. The department revised the Biology Exit exam and administered the new version in Spring 2019. We evaluated the question types and quality based on individual exam item analysis results, critical thinking and application of science questions, and for balance between each core area and content vs critical thinking. However, the process was not completed fully this academic year. This objective will be carried over the 2019-2020 academic year.
4. The Biology Department began its investigation of validated questions from Concept Inventories to be used on our exams, however, the process was not completed fully this academic year. This objective will be carried over the 2019-2020 academic year.

SLO 3.0: Students will explain and demonstrate how to 1) ask a question, 2) generate a credible literature review, 3) generate hypotheses, 4) execute hypothesis testing procedures, 5) organize and analyze data or information, 6) draw conclusions, and 7) produce a report to cogently communicate results at or above a score of 3.5. The proportion of students that achieve a score of 3.5: Baseline (last year's results) of 31%, Benchmark of 35%, Target (5 year) of 40%.

SLO 4.0: Students will cogently communicate cogently about biology at or above a score of 3.5. The proportion of students that achieve a score of 3.5: Baseline (last year's results) of 31%, Benchmark of 35%, Target (5 year) of 40%.

SLO 3 and 4:

The Biology Department again used the scoring rubric developed primarily for presentations.

1. The department will continue to utilize the rubric in evaluation of student projects in RED and PURE. We will include the fall 2019 PURE presentations in our evaluation.
2. To increase the consistency in the evaluation of student presentations, at RED and PURE, we will again task a group with evaluating all the biology students presenting as we did in 2019 – 2020. We will also increase the number of evaluators.
3. Given our rubric was designed primarily for presentation-based assignments, a number of

individual questions are not applicable to written assignments. Therefore, in fall 2018 the department began developing additional rubrics for use evaluating other types of student assignments (e.g. oral presentations, in-class poster presentations, and in-class laboratory assignments in appropriate upper-level courses). Work on this objective is not complete and will be carried over the 2019-2020 academic year.

4. We decided to expand the use of the rubric to increase consistency in common courses and lab sections. This objective will be carried over the 2018-2019 academic year.
5. We discussed the feasibility of an evaluation committee to score in-class presentations and written laboratory reports to allow for repeat measures of assignments that would otherwise receive one evaluation from the instructor of record. This objective will be carried over the 2019-2020 academic year.
6. In Fall 2019 we will ensure that faculty that do projects with students reinforce the areas of the scientific process and communication with their research students.
7. In 2018-2019, we have incorporated more assignments that require students to apply the process of science into our courses.
8. We facilitated the process by which faculty can mentor students in research projects outside of the classroom.
9. To notify students of research opportunities, we continued to use the *Research Opportunities* section of the bulletin board outside the biology office, we increased the frequency of updating of our website section, and we created a new website this year to showcase our active research areas. Additionally, a monitor installed in the main hallway in the biology department will continue to be used to announce opportunities.

SLO 4: The Biology Program worked on designing a writing assignment program likely using a scaffolding approach to be used in the freshman course sequence. Implementation of a writing program has been rolled into the program's discussion on redesigning our curriculum. We made progress but this objective will be carried over to the 2019-2020 academic year.

Appendix 1 – Presentation Rubric

Project: _____ (poster number)

What was most impressive about this project/presentation?

What change could most improve this project/presentation?

Low → High

SCIENTIFIC THOUGHT

Degree to which the student clearly states a thoughtful question. 1 2 3 4

Degree to which the student clearly state their research hypothesis or purpose 1 2 3 4

Is the significance of this research clear in terms of the 'big picture?' 1 2 3 4

SCIENTIFIC METHOD

Is the method of investigation appropriate to the problem? 1 2 3 4

Is the information sufficiently documented? 1 2 3 4

Has the student collected sufficient data to justify the conclusions made? 1 2 3 4

Has the student analyzed the data in a way to justify the conclusions made? 1 2 3 4

Is the student's own work clearly reflected in the project? 1 2 3 4

COMMUNICATION

Does the presentation (display) represent a complete story or concept? 1 2 3 4

Is the presentation (display) self-explanatory? 1 2 3 4

Do the text, charts, and diagrams aid in the understanding of the project? 1 2 3 4

COMMUNICATION (In person only)

Does the presenter give a clear and concise description of the project? 1 2 3 4

Does the presenter communicate effectively in oral responses to questions? 1 2 3 4

RATING GUIDELINES
 Low → High
 1 – Fair
 2 – Good
 3 – Excellent
 4 – Superior

Presentation type
 Poster presentation
 Course assignment (BIO _____)
 Other _____

Additional Comments may be place on the reverse

**Adapted from Sigma XI Student Research Conference Template*