

# **Institutional Effectiveness Report**

## **General Education**

**Department of Biology**  
**Academic Year 2018-2019**

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## **Executive Summary of Report**

The Biology Department assessed student achievement in the two general education courses offered by the department (Bio 103 and 104) with cumulative exams. This academic year we implemented the use of “pre-post testing” to assess achievement from the beginning to the end of the semester in both courses. We created different but comparable forms of each exam to ensure that the student is not taking the same exam twice. Results show good achievement but room for improvement in both sets. We will continue discussions of these issues related to achievement. To improve student performance we will enhance instruction in areas we determine from the exam results need to be reinforced.

### **General Education - Science-Related Student Learning Outcomes:**

There are three learning outcomes of the general education that are science-related:

1. The student will have an understanding of the natural world.
2. The student will be able to think critically and to apply scientific principles to reach conclusions.
3. The student will be able to use technology.

### **Assessment Methods**

1. The student will have an understanding of the natural world at the overall average of: Baseline 59%, Benchmark 60%, Target 64%, as measured by a cumulative exam.
2. The student will be able to think critically and to apply scientific principles to reach conclusions at the overall average of: Baseline 62%, Benchmark 60%, Target 64%, as measured by a cumulative exam.
3. The student will be able to use technology as measured by the proportion of courses that require that students use at least one form of technology (Baseline 93%, Benchmark 90%, Target 93%)

The Department of Biology offers two courses that non-majors may take to complete science-related general education requirements at FMU (Biology 103 and 104). To assess student success in meeting the science-related learning outcomes 1 and 2 above, a course-specific cumulative exam (multiple choice format) was administered. We implemented the use of “pre-post testing” to assess achievement from the beginning to the end of the semester in each course. We created different but comparable forms of each exam in both courses to ensure that the student is not taking the same exam twice. Only one of the courses is offered in a semester. We administered the exam to Biology 103 students at the beginning and at the end of the Fall semester 2018 and to Biology 104 students at the beginning and at the end of Spring 2019. In each course students are expected to achieve a benchmark of 60% or higher on the cumulative exams. We regard the mean percent score of the exam results to be a reasonable indicator of student-success in meeting the two science-related general education learning outcomes.

Student use of technology (SLO 3) is incorporated into the required laboratory portions of the non-majors courses. All students gather data and use technology and instrumentation in a variety of laboratory exercises in these courses. For example, students use scientific instrumentation to gather data and do statistical testing, use spreadsheets, and create graphs to evaluate the data collected. The process of gathering the necessary data for each laboratory exercise requires accuracy in taking measurements and using the technology and instrumentation correctly.

We also assess learning outcome 3 by the proportion of courses that incorporate technology in some form. Access to and use of technology is imbedded into biology courses in a variety of ways. Student use of technology is incorporated into both lectures and the laboratory portions of the biology courses and students must successfully use the technology to complete assignments. All students gather data and use technology and instrumentation in a variety of laboratory exercises in these courses. Students must successfully use scientific instrumentation to gather data, and software to use spreadsheets, and do statistical testing, and create graphs to evaluate the data collected to complete assignments. The process of gathering the necessary data for each laboratory exercise requires accuracy in taking measurements and using the technology and instrumentation correctly. In addition to data collection required all laboratories, specific instrumentation is used in lecture sections and laboratories. Our benchmark is 90% of our courses require that students use at least one form of technology (Baseline 93%, Benchmark 90%, Target 93%). This benchmark adjusts for courses that may not lend themselves to use of technology such as diversity of organism courses.

## **Assessment Results**

### **Student Learning Outcomes**

1. The student demonstrated an understanding of the natural world at an average Baseline - average of Bio 103 and Bio 104: 63%, Benchmark 60%, Target 64%, as measured by a cumulative exam. The benchmark and target were achieved by both Bio103 and Bio 104 students.
2. The student demonstrated the ability to think critically and to apply scientific principles to reach conclusions at a benchmark overall average of Baseline - average of Bio 103 and Bio 104: 57%, Benchmark 60%, Target 64%, as measured by a cumulative exam. The benchmark was achieved for both Bio 103 and Bio 104. Since the target was 64%, the target was also achieved by Bio 103.

Tables 1 and 2 below list the exam questions that apply to each learning outcome and summarize the results. The BIO 103 exam was revised this year. We administered exams at the beginning and the end of the semester in both courses.

Table 1. Summary of results of the Biology 103 cumulative exam administered in Fall 2018 at the beginning and at the end of the semester and results from the end of the Fall 2017.

Student Learning Outcome	Assessment (question that pertains to each learning outcome)	Result (Mean percent correct)		
		Fall 2017 End	Fall 2018 Beginning	Fall 2018 End
1. The student will have an understanding of the natural world.	6-8, 11-15	57.9	53.3	67.3
2. The student will be able think critically and to apply scientific principles to reach conclusions.	1-5, 9,10,16-18	59.3	50.1	65.2
Number of students		87	144	128
Overall mean		58.6%	50.8%	66.1%

Table 2. Summary of results of the Biology 104 cumulative exam administered in Spring 2019 at the beginning and at the end of the semester and results from the end of the Spring 2018 semester.

Student Learning Outcome	Assessment (question that pertains to each learning outcome)	Result (Mean percent correct)		
		Spring 2018 End	Spring 2019 Beginning	Spring 2019 End
1. The student will have an understanding of the natural world.	1, 2, 4,6-8, 10, 11,15, 17, 19,21-23	67	46.5	69
2. The student will be able think critically and to apply scientific principles to reach conclusions.	3, 5, 9, 12 -14, 16, 18, 20, 24, 25	55	46.3	57.3
Number of students		48	57	47
Overall mean		62.2%	46.4%	63.8%

Biology 103: Students achievement exceeded the benchmark of 60% and target of 64% for both the overall exam average and on questions that assessed achievement of both SLO 1 (understanding the natural world) and SLO 2 (critical thinking and applying scientific principles). Achievement improved (18%) by the end of the semester and increased compared to last year.

Biology 104: Student achievement (overall exam average) at the end of the semester met our benchmark of 60% for the overall average and essentially met our target of 64%. Overall achievement increased from the beginning to the end of the semester and increased slightly over last year's results. Achievement on the questions that assess SLO 1 (understanding the natural world) was above our benchmark and the target. Results for SLO 2 (critical thinking and applying scientific principles) did not meet the

benchmark. The results separated by SLO mirror last year's results.

### Student Learning Outcomes

3. The student will be able to use technology as measured by the proportion of courses that require that students use at least one form of technology (Baseline 93%, Benchmark 90%, Target 93%). The benchmark was met.

Students use technology and instrumentation as they gather data and analyze results to complete laboratory exercises.

Access to and use of technology is imbedded into biology courses in a variety of ways. On-line courses are dependent on technology; Bio 104 lecture was taught as an on-line course this spring. Table 7 lists technology used in Biology courses and laboratories. The majority of lectures and labs (average = 93%; fall 17/18 = 94%; spring 21/23 = 91%) have some exposure to technology imbedded into them. Thus, we met our benchmark of 90% of courses requiring students using some form of technology. A variety of technology is incorporated by instructors into our courses at all levels into both lectures and laboratories. The types of uses vary including posting grades and assignments, on-line quizzes, and use of software programs and instrumentation in laboratories. In addition to the listings below, Excel and Prism (graphing program) are the programs that the department are used routinely by courses that require data analysis and graphing.

Table 7. Types of technology, the uses, the courses this technology is incorporated.

Program	Use	Course number
Blackboard	posting grades, announcements, resources, course notes, homework	102, 103, 104, 105, 106, 115L, 120, 202, 205, 210, 215, 301, 302, 303, 305, 307, 308, 311, 312, 317, 320, 401, 406, 407, 409, 412
	On-line quizzes	102, 103, 105, 104, 305, 308, 401, 407
	Submit assignments	406
Textbook/publisher website/resources	Homework, assignments, quizzes	105
	Virtual labs, exercises	205, 401
Other programs	ArcGIS	202, 308, 402, 411
	Mesquite	106, 409
	Other course specific programs: e.g., Modelling programs, videography	102, 106, 306
iPads	Data collection	306, 412
Instructor created websites	Course resources, grades	215, 236
Vernier and Pasco Probes (various), O2 & pH meters, EEG	Lab data collection	103, 104, 115, 120, 236, 406, 308, 317



### **Action items**

An action plan that addresses the following areas is being developed for implementation during the next academic year:

### **Student Learning Outcomes**

1. The student will have an understanding of the natural world.
2. The student will be able to think critically and to apply scientific principles to reach conclusions.

1. We will continue to administer the cumulative exams in both semesters (Bio 103 Fall, Bio 104 Spring) and to as many sections of the courses as possible.
2. To improve student achievement, faculty will reinforce certain core principles and concepts and critical thinking skills. We will ensure that instruction will be enhanced in the areas where targets were not achieved (Bio 103 – concepts and critical thinking).
3. We implemented pre- and post- exams at the beginning and end of the courses this academic year and will continue this practice in the 2019-2020 academic year. In Bio 104 we created different but comparable forms of each exam to ensure that the student is not taking the same exam twice. Creation of different but comparable forms of each exam for Bio 103 was completed but refinement of them will be carried over to the 2019-2020 academic year.
4. We evaluated the exams for balance between content vs critical thinking. However, the exams will be evaluated based on test item statistics and individual question analyses will be completed to determine if more question refinement is warranted. That evaluation and revision of the exams to better assess the students will be carried over to the 2019-2020 academic year.

### **Student Learning Outcomes**

3. The student will be able to use technology.
1. We will continue to discuss ways to encourage faculty to find methods to incorporate technology into their courses.
2. Some biology instructors shared ways they currently use the various features of Blackboard with the department. We will continue these discussions and include discussions of other types and uses of technology in the classroom to increase student use of technology in our courses.
3. The Biology Department's investigation into methods to better assess student achievement of this student learning outcome was not completed this year and will be carried over to the 2019-2020 academic year.