

Department of Biology Annual Assessment Report 2019-2020

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1. *Recounting the assessment cycle.*

This report accounts for our recent assessment cycle:

- academic year 2017-18: a YeAP was submitted
- academic year 2018-19: assessment data were acquired and compiled
- academic year 2019-20: this report is being submitted

This assessment cycle addresses our recent (implemented during the 2018-19 academic year) student-centric changes to our first year curriculum in an effort to improve student achievement within the General Biology courses (BIO101 and BIO102) as well as improved retention within the biology program overall.

Previously, the General Biology lectures took place with all the enrolled students together in a large lecture hall (e.g., BIO 101 served between 80-130 students each year over the past several years). During the 2017-18 academic year, the faculty of the Department of Biology decided to invest a larger proportion of our faculty resources in order to divide these large lecture courses into a set of smaller parallel courses with individual faculty serving approximately twenty students. This new approach was first enacted during the 2018-19 academic year. A number of motivations prompted these changes:

1. The larger lecture hall environment likely has detrimental effects on student engagement.
2. This logistical change enabled our faculty to be able to more effectively make use of active learning techniques within the context of the lectures.
3. The large classroom environment did not correlate with the overall mission and values of the university.

The goals for the General Biology courses involve establishing foundations of knowledge, with primary emphasis on the major themes of biology and how these themes relate to biological processes. Thus, the following learning goals, arguably the most significant for

students who are being introduced to the biological sciences, were assessed during this cycle:

- Content – Students will develop a firm comprehension of the fundamental concepts of biology and be able to identify the relationship amongst diverse biological fields as well as interfaces between biology and other scientific disciplines.
- Application – Students will utilize biological methods of inquiry to solve problems, design experiments, and interpret observations/results in both an independent and collaborative manner.

This cycle of assessment enables the faculty to determine if the changes to the course pedagogy improved student learning in regard to the above goals. Furthermore, Furthermore, additional factors that might influence student retention in the program were assessed, specifically:

- Any perceived impact on student learning and academic skills
- Student satisfaction with class size, course, and instructor
- Student satisfaction with pedagogy

2. Describe assessment measures that were used.

Two assessment measures were used.

A pre- and post- assessment exam series. This is a direct measure of assessment that we have been using for the past six years in the introductory courses. This series of questions were given to the students in the new format BIO101 and BIO102, and the results of these exams were compared to the results of the previous years. This assessment was used to assess the content goal.

A questionnaire, as a part of the course evaluation procedure. This consisted of a series of questions for Likert scale response as well as a small number of open-ended questions intended to elicit from students their (1) responses toward course pedagogy, (2) reflections on their learning in the course, and (3) thoughts on large versus small class size. This assessment could also be used for us to indirectly correlate student learning with

approaches that addressed the application goal of our assessment plan. A copy of this questionnaire is included with this report.

3. Summarize the data/results from your measures.

Table 1 (below) shows the results from the pre- and post- assessment exam.

Table 2 (below) shows the data acquired from the questionnaire (Likert scale).

A summary of responses from the open-ended questions follows.

- Of the students who discussed an impediment to their learning, 35% (n = 23) of the BIO101 students reported the course rigor as a major impediment, in contrast to 11% (n = 18) BIO102 students. A larger proportion of BIO101 students also reported issues with their academic skills, such as time management or general study skills (65%, n = 23) compared to BIO102 (33%, n = 18). This is most likely due to a difficulty for first semester student to transition from high school to the expectations of college. However, it also appears that many of our majors quickly adapt to these expectations.
- In BIO101, although a large majority of respondents (80%, n = 30) reported an improvement in their academic skills, there were still a relatively large number of students who reported no improvement (20%). This is in contrast to those in BIO102, where only 6% (n = 16) mentioned no improvement.
- For students in both BIO101 and BIO102, the group activities were often cited as effective learning approaches (49%, n = 43; and 39% n = 27; respectively).
- In BIO101, the use of traditional lecture approaches were overall less favored, with 16% (n = 43) of respondents listing lectures as the most effective approach while 50% (n = 22) listed it as the least effective approach.
- BIO102 made use a “flipped” course approach, and this appeared to be a polarizing issue for the students. For those students who discussed their most effective and least effective approaches to learning, 48% (n = 27) found the flipped classroom to be most effective while 50% (n = 20) regarded the flipped classroom as their least favored approach. Students who favorably discussed the videos associated with the flipped classes mentioned that they could rewatch the videos or learn at their own pace, which is something typically unavailable to them within the context of a traditional lecture.

- The small class size was overwhelmingly favored, with 93% (n = 41) in BIO101 and 93% (n = 29) in BIO102 reporting approval.
- Upon reflection, respondents in both courses often mentioned time management as a skill that is needed to be developed for success in the course (40%, n = 60). Additional deficient academic skills of note were making use of office hours (20%) and developing effective note-taking skills (17%).

Table 1: results from pre- and post-exams

year	# students	percentage correct BIO101 pre-exam	percentage correct BIO101 post-exam	factor increase
2018-19	54	39.0	75.1	1.93
2017-18	75	44.8	76.1	1.70
2016-17	79	39.4	67.1	1.70
2015-16	98	41.1	64.7	1.57

Table 2: student response to General Biology questionnaire

Criterion	BIO101 score^{*a}	BIO102 score^{*b}
Perceived impact on student learning		
I feel confident that I understand the major biological concepts that were covered in this course.	3.7 ± 1.0	4.0 ± 0.9
I feel that I would have been more successful if I had studied more.	4.0 ± 0.9	3.6 ± 1.1
I took advantage of my professor's office hours.	2.8 ± 1.1	2.9 ± 1.1
I believe that my study methods were effective.	3.4 ± 1.1	3.3 ± 1.1
I believe that my note-taking skills improved over the course of the semester.	3.6 ± 1.0	3.7 ± 1.1
I feel that I learn better if I discuss concepts with my peers.	4.3 ± 0.8	4.0 ± 1.1
I prefer to learn on my own.	3.5 ± 1.0	3.5 ± 1.1
My grade in this class accurately reflects my success in learning	3.4 ± 1.2	3.1 ± 1.3
Student satisfaction with class size		
I feel that a small class size enabled me to better grasp the concepts during lecture.	4.7 ± 0.5	4.7 ± 0.6
The small class size has enhanced my ability to learn while in the classroom.	4.4 ± 0.7	4.3 ± 0.6
I felt compelled to attend lecture.	4.5 ± 0.8	4.2 ± 1.1
I would have preferred lectures in a larger room with 60 students.	1.5 ± 0.8	1.4 ± 0.8
Student satisfaction with course/instructor		
I felt comfortable getting to know the instructor.	4.3 ± 0.9	4.4 ± 0.8
My attitude toward this course was in part influenced by upperclassmen.	2.3 ± 1.1	2.5 ± 1.2
I feel that it is important to try to get to know my instructor.	3.9 ± 0.7	4.1 ± 0.8
I registered for this class primarily due to my interest in biology.	4.0 ± 1.1	4.1 ± 1.0
This class has enhanced my interest in biology.	3.8 ± 1.2	4.1 ± 0.9
Student satisfaction with pedagogy		
I feel that the case studies used during the semester enhanced my understanding of the concepts covered during lecture.	4.0 ± 1.0	3.5 ± 1.2 6
I feel that my class was able to function as a community of learners.	3.6 ± 1.0	3.7 ± 1.1
I feel that the questions on the exams accurately reflected what I was		

4. Describe the process by which you evaluated your data.

These data were compiled by the assessment liaison and distributed to all tenure-line faculty within the department as well as the general biology lab instructor. The faculty were allotted a one week period to reflect on the data prior to a discussion at a department meeting. The liaison then compiled the information for the report.

5. Describe what you learned as a result of the evaluation process.

Overall, based upon the data acquired from the questionnaire, it appears that students responded positively to the changes made to the course. Approaches that appeared to be most highly favored were opportunities in class to discuss concepts with their peers as well as opportunities to explore scenarios that enable an application of concepts presented in the course. Importantly, these changes appeared to have succeeded to a fair degree in altering the attitude of the students toward this introductory biology course. Despite the fact that the rigor remained, the course was viewed less as an academically hostile (student vs instructor) environment; instead, students perceived and accepted (to some extent) the fact that the instructor genuinely endeavored to facilitate student learning while still maintaining high expectations. Complaints in regard to differences between sections were very rare. While student attitudes in regard to "fairness" were not directly requested, it is reasonable to expect that a student with strong feelings about this issue would make sure to mention their concerns in any form of feedback.

In regard to the direct (pre- and post-exam) assessment for the content learning goal, we found student performance improved compared to previous years. This suggests that the changes implemented in the courses indeed had a positive effect on student learning, at least in regard to understanding the fundamental content expected in an introductory course. However, there are a couple caveats. For one, these data represent a limited sample size (only one year of data in regard to the altered course structure). Furthermore, in order to integrate active learning approaches, the members of the Department of Biology agreed to eliminate certain areas of content from the introductory courses. A large proportion of the removed content is ancillary to an introductory course, and it is that which we found students struggle the most. It is our expectation that these concepts will be addressed in later coursework. Out of necessity, questions dealing with content that was not covered were removed from the exam. Due to this, it is difficult to make any

definitive conclusions with certainty. Nevertheless, the Department of Biology remains hopeful that similar results will be found over successive years.

The application learning goal was addressed via the solicitation of student responses to statements or questions. We recognize that this learning goal should be addressed more robustly with the incorporation of direct measures. As of this time, a direct assessment methodology is only in the formative stages.

Beyond the learning goals, the Department of Biology also has a vested interest in the retention of students who matriculate as biology majors. The experiences of these first-year students have a tremendous influence on any decisions these students make as they continue their education in the second year and beyond. The changes we have implemented are in part meant to address this issue, including the development of the SEED program, which both involves the production of an eportfolio by each student and emphasizes reflective advising for our majors. An examination of the data for enrollment since Fall 2018 reveals that 73 students were enrolled in BIO101 while 61 students continued with BIO102 (these numbers include up to nine students who were biochemistry majors). From this original cohort of biology majors, 39 have continued into their sophomore year as biology majors; therefore, approximately 25 may have left the major over the past year. Retention is difficult to assess, as a student might leave the major for a variety of reasons not relating to academic performance or interest in the major.

6. What does your academic unit plan to do with the information it has evaluated?

Overall, the data acquired suggest that the tactics currently being implemented in the introductory courses have been successful in improving student learning within the major. However, the Department of Biology recognizes that there is still work to do as we continue to improve the student learning experience within the BIO101 and BIO102 courses. Over the past two years, the faculty (either as a whole or as course-specific groups) held periodic meetings discussing the teaching of these courses. We expect that these periodic meetings will continue, and we will use them to address issues relating to improvement of the introductory curriculum. Our future discussions include the following:

- We should continue to work with students to develop their academic skills. A major hurdle to this is to find ways to compel the students to reflect on their skills *early* in the semester, recognize their deficiencies, and to put forth an honest effort to improve these skills.
- We can further develop active learning approaches while still maintaining an appropriate level of content within the course. This will likely entail placing further responsibility on the student in regard to the learning of “the basics” outside the classroom. This is a reasonable scenario given that IWU is a selective institution, the students accepted into IWU have a certain (non-zero) level of academic proficiency, and the instructors will provide guidance for the students.
- As a corollary to the above, we can improve how we communicate our expectations with students, not only in regard to an expected knowledge base for an exam, but also note-taking skills, daily study activities, achieving a depth of knowledge, thoughtful communication of ideas, etc.
- We are currently reevaluating how the laboratory experience for BIO101/102 coincides with the lecture material. In the past, a large proportion of the lab exercises emphasized the development of skills in regard to experimental design, data analysis and hypothesis testing, and scientific communication. While we intend to retain these vital elements within the laboratory experience, we will use the following questions to drive further discussion: Does the lab experience need to reflect and enhance the lecture experience? Is a consistent experience between lab sections necessary?
- The Department of Biology is in the midst of reorganizing our entire curriculum. We are taking a bottom-up approach, where we have undertaken changes to the introductory lecture courses and developed a new series of second year course requirements (BIO212 Genetics and 216 Evolution). With these changes, we will need to develop new direct assessments for both years. In addition, we will need to develop indirect assessments for the second year courses, including an evaluation of how learning in the 100-level courses impacts student learning and performance in the 200-level courses.
- The SEED program (Showcasing Evidence of Experience and Development) utilizes a four-year structure for the growth of the academic and professional goals of our students. This past year was the first year of the program. In the near future, we should begin work to assess the efficacy of this program.

Biology 101/102 course evaluation

Please respond to the following statement by indicating your level of agreement/disagreement according to the choices below. Please write all responses on the provided lines.

- 1.....strongly disagree
- 2..... disagree
- 3..... neutral/ambivalent/apathetic
- 4..... agree
- 5..... strongly agree

1. ____ I feel confident that I understand the major biological concepts that were covered in this course.
2. ____ I feel that a small class size enabled me to better grasp the concepts during lecture.
3. ____ I registered for this class primarily due to my interest in biology.
4. ____ I feel that I would have been more successful if I had studied more.
5. ____ I felt comfortable getting to know the instructor.
6. ____ I took advantage of my professor's office hours.
7. ____ I feel that the case studies used during the semester enhanced my understanding of the concepts covered during lecture.
8. ____ I believe that my study methods were effective.
9. ____ I believe that my note-taking skills improved over the course of the semester.
10. ____ I feel that my class was able to function as a community of learners.
11. ____ What letter grade do you think you will earn in this course? (Please indicate on the line)
12. ____ I feel that I learn better if I discuss concepts with my peers.
13. ____ I prefer to learn on my own.
14. ____ I feel that the questions on the exams accurately reflected what I was expected to learn from the lectures.
15. ____ The small class size has enhanced my ability to learn while in the classroom.

successful not only in promoting student learning but student retention within the major. While we will need to continue this assessment to acquire data beyond a single year, we believe that we have made great strides toward meaningful improvement of our curriculum. With this information, going forward, the Department of Biology will 1) continue to make nuanced changes to this newly established first year curriculum and 2) build on the approaches of the first year experiences as we transition our efforts to the second year curriculum.