

STUDENT LEARNING ASSESSMENT REPORT (2017 – 2018)

PROGRAM: Biology (BS)

SUBMITTED BY: Amanda Wright

DATE:

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EXECUTIVE SUMMARY

Program description from the Course Catalog: Please copy and paste the current year's catalog description of this program. This is generally a one-two paragraph description immediately following the name of the program. Please be sure to include the listing of program outcomes as printed.

Currently, the 2017-2018 course description for Biology (BS) states:

Study in the biological sciences responds to the increasing demand for scientific expertise in a variety of professional settings, including industry and law. The program permits students to build on a common foundation of introductory courses in biology and chemistry. It provides preparation for advanced studies in biology and health-related professional fields, or for entry into a variety of areas within the biotechnology industries.

Upon successful completion of the biology program, students will be able to

- apply gained knowledge and experience to a complex, current scientific problem;
- demonstrate the ability to apply knowledge gained from the major in a professional setting;
- demonstrate an understanding of and competency in basic scientific skills such as observing safe laboratory practices and making solutions;
- formulate hypotheses, design a project, and gather and analyze data to address scientific questions;
- display an understanding of ethical dilemmas and social issues and apply their understanding to situations in professional settings; and
- demonstrate scientific literacy by communicating synthesis of knowledge and critical analysis of read scientific information

During Spring 2018, the biology department wrote and implemented revised program learning outcomes. These changes have been submitted to our assistant dean, the office of planning and institutional effectiveness, and the registrar's office. At the time of the drafting of this report (Summer 2018) the program learning outcomes have not been updated in the catalog. However, upon the recommendation of the Office of Planning and Institutional Effectiveness, we used these newly written outcomes to conduct assessment for this report. Once catalog changes have been put into place for, it will read as stated below:

Upon successful completion of the biology program, students will be able to

- formulate scientifically sound hypotheses;
- demonstrate effective oral and written scientific communication skills;
- understand the moral and ethical impact of science on their communities, both local and global;
- integrate a range of scientific concepts and ideas

List all of the program's learning outcomes: (regardless of whether or not they are being assessed this year)

Goals	Learning Outcomes	Year of Last Assessment	Assessed This Year	Year of Next Planned Assessment
1. Students will be able to independently conduct and evaluate scientific research.	1. Students can formulate scientifically sound hypotheses	new	yes	2019-2020
	2. Students can design and implement a research project	new	yes	2019-2020
	3. Students can analyze data and draw conclusions	new	yes	2019-2020
	4. Students can critically evaluate scientific literature	new	yes	2019-2020
2. Students will be able to demonstrate effective oral and written scientific communication skills.	1. Students can develop coherent written arguments.	new	yes	2019-2020
	2. Students can write using current scientific styles.	new	yes	2019-2020
3. Students will understand the moral and ethical impact of sciences on their communities, both local and global.	1. Students will identify ethical dilemmas associated with current scientific innovations	new	no	2018-2019
	2. Students will follow ethical norms of scientific communication the final outcomes	new	no	2018-2019
4. Students will be able to integrate a range of scientific concepts and ideas.	1. Students can make connections between similar content ideas from different courses	new	no	2018-2019

Describe briefly how the program's outcomes support Marymount's mission, strategic plan, and relevant school plan (generally not more than two paragraphs, may use bullet points):

During the past academic year, our department updated and revised our program learning outcomes based on major overall goals that we felt were important for our graduates to be successful as scientists in their careers and in their communities. We compiled these goals and outcomes with great care and consideration of Marymount's mission, vision, and strategic plan. It is evident in our curriculum that we have a strong commitment to intellectual curiosity and this is something we emphasize throughout a student's academic career at Marymount. We demonstrate this in a variety of ways, most prominently through our active undergraduate research programs. We have a strong record of success in training undergraduates to do effective, relevant, impactful research that has been presented at national and international meetings and/or published in scientific research journals. The level of engagement we have with one-on-one student-faculty training is unique in a scientific undergraduate environment and something we feel strengthens our department and is an effective recruitment and retention tool. We will be working during the next academic year to develop tools to better assess these experiences.

Our department has a strong commitment to promoting career preparation within a liberal arts framework. Our first two goals and associated outcomes are a direct result of this commitment. Through the process of building a solid foundation of knowledge in the current fields of biology and biochemistry, developing the student's ability to conduct and evaluate scientific research, and promoting effective oral and written scientific communication skills, we give them not only an excellent education but also the tools to become effective members of society in any field they chose. Our required departmental internship is a capstone experience, which provides an opportunity for personal and professional growth of our students and provides a stepping-stone to jobs after graduation. Many of the projects in our introductory through advanced level courses require interpretation of primary research, group work and classroom presentations and our departmental writing intensive course, Bio 300, hones the students' technical writing skills.

Our third goal and associated outcomes demonstrate our level of commitment to education of the whole person and guiding the ethical development of our students. Many of our courses contain modules that focus on ethical and social issues designed to help students identify ethical dilemmas and follow ethical norms. In addition, we have several research projects within the department that center around service to others and provide our students with true global experiences.

Our programs have consistently demonstrated a strong commitment to academic excellence and we continue to emphasize a rigorous, cohesive, integrated curriculum that enables our graduates to succeed in careers or pursuits of advanced degrees. The content of our introductory through advanced science courses provide the foundational knowledge and spark their interest in general biology, chemistry, physics, genetics, microbiology, botany, parasitology, endocrinology, immunology, virology, biochemistry, and environmental topics. Our last general goal and outcome is a measure of our student's ability to make connections and integrate information from the various courses they take during their scientific careers at Marymount.

Provide a brief description of the assessment process used including strengths, challenges and planned improvements to the process, and provide evidence of the existence of a culture of continuous improvement based on assessment (*generally not more than two paragraphs, may use bullet points*):

Brief description of the assessment process used including strengths, challenges and planned improvement

As described above, we spent the previous academic year (2017-2018) reevaluating our learning outcomes and exit exam, which is used as a primary direct measure of many of our outcomes. In light of our program objectives and Marymount's mission, vision, and strategic plan, we wrote new program goals and measurable outcomes. In addition, we wrote an entirely new exit exam to better coordinate with these goals and outcomes. We hope that the implementation of this new exit exam will improve the value of the data and information we obtain and provide a more accurate assessment of our outcomes. In addition to this strong direct measure, we also use rubrics and information from courses as our majors move through the program to assess our learning outcomes. Some of the courses used are BIO 151-152 General Biology for Majors, BIO 300 Writing for Science, and BIO 410 Senior Seminar. We also have several strong indirect measures, including the Graduating Senior Survey (GSS) and the University and Biology Department Alumni Surveys. This year, we implemented an assessment workshop where several faculty met at the end of May to evaluate and compile assessment data so reports could be written during the remainder of the summer. This process seemed to work pretty well and helped to encourage cooperation and participation from several faculty in the assessment process.

Currently, our challenges include sifting through a tremendous amount of data in an efficient, organized way so that the assessment process is not too demanding on any faculty subset. For the upcoming year, we plan to devise assessment tools for our undergraduate research experience. Several faculty have recently attended workshops on this topic and we believe we can receive grant support to develop these tools and, once they are in place, we could receive more external funding for our on-campus research experiences. In addition, we have planned improvements to the way we collect data that will make analysis and interpretation easier and will eliminate confusion. Lastly, we will be working to revise the exit exam based on information obtained during the writing of this report. Now that we have updated goals and outcomes in place, we will be working in the coming year to be more intentional about the tools we use to assess each outcome.

Evidence of the existence of a culture of continuous improvement based on assessment

From an assessment perspective, the strongest evidence of this continuous improvement is the work done this past academic year to reevaluate our learning goals and outcomes and better align our exit exam with these learning objectives. This is based on feedback we have received from the committee for several years and we believe that this new way of assessing our students will be more useful to us as individual faculty and to the department as a whole. From a curriculum perspective, we are continually tweaking curriculum to better support our students and their learning needs, as well as support the goals of the university. For example, we have implemented several new research topics that involve service to others (3D printing of prosthetics hands and a community garden and other efforts to help food insecure populations). We had evidence to suggest that our students desire these types of experiences and both of these projects have been successful at drawing in not only biology and biochemistry students, but also students from across the university. Another example of continuous improvement is in the establishment of the new Biology (BA) curriculum. Based on feedback from former students and the career path chosen by many of our graduates, we determined that a BA curriculum, where students are exposed to a larger breadth of liberal arts disciplines, could be beneficial. We have achieved this objective with the implementation of our BA curriculum. This program was just recently implemented but we believe will be

attractive to many students in the coming years. Lastly, individual faculty consistently modify coursework to improve overall understanding and improve performance on essential topics, such as mathematical manipulations, unit conversions, basic lab skills, and ethical considerations.

Describe how the program implemented its planned improvements from last year:

Outcome	Planned Improvement	Update <i>(Indicate when, where, and how planned improvement was completed. If planned improvement was not completed, please provide explanation.)</i>
Students will apply to a complex, current scientific problem, gained knowledge and experience. (Identified as an inquiry outcome.)	<p>Many of the professors have added and are using active learning modules in their courses, which we feel contributed to the learning outcome. Many of these learning modules include research readings. We will continue to use these modules and to develop new ones.</p> <p>Prompted by the contrast between the strong scores for the other measures and the lower than expected scores on the research interpretation section of the exit exam, we took a look at how the exam actually looks for the students. We found the electronic file was no longer appearing clear and part of the information was cropped from the research figure. We plan to substantially re-do the exit exam this year and will address this situation. In addition, we will continue to more intentionally work within our learning modules to strengthen approaches students take when reading primary research articles.</p>	<p>We continue to employ active learning strategies – from inquiry projects to clickers to case studies to reenactments to independent research – to engage our students and give them opportunities to use their knowledge and experience. We are consistently tweaking and adding new modules to courses.</p> <p>Based on suggestions from the assessment committee and detailed review of previous assessment data, we wrote a new exit exam that more closely correlated with our learning outcomes as opposed to the content-based exam we were using. In addition, we wrote new learning outcomes that represent the hallmarks of a biology/biochemistry education at Marymount.</p> <p>We are working to create assessment tools for our undergraduate research experience, which will include analysis of student’s ability to interpret research. This will be completed during the 2018-2019 academic year. We have not achieved this yet due to our work rewriting our learning outcomes and exit exam during the 2017-2018 academic year.</p>
In a professional setting, students will demonstrate ability to apply knowledge gained from their Biology and Physical Science major.	To address some of the comments from our alumni surveys, we will make the following improvements. For biochemistry and botany, two courses we implemented in response to repeated student requests, we will continue to improve the active learning modules and lab components to make sure students remain confident in their preparation. We will offer research reading projects in our required courses to ensure scientific literacy. Other suggested classes, including pharmacology, toxicology, and pathology will be taken under consideration.	The biochemistry laboratory has been completely redesigned to be a more independent learning experience and simulate more ‘real world’ scientific research. Students gain confidence in experimental design, scientific literacy, lab skills and techniques, and data analysis and presentation. Introductory courses have also implemented more intentional assignments designed to promote scientific literacy.
Students will demonstrate competency in basic scientific skills such as observing safe laboratory practices and making solutions.	To maintain our strong development of technical lab skills, we will continue to provide many opportunities in lab courses for acquisition and monitor the GSS scores for the selected questions to make sure they continue to improve. In response to the desire to further enhance their skills for job and post-graduate academic	These improvements have been implemented with the introduction of more independent opportunities for our students from introductory biology and chemistry classes to our junior level advanced lab research methods to upper-level biochemistry and molecular biology and independent research projects. We have

Outcome	Planned Improvement	Update <i>(Indicate when, where, and how planned improvement was completed. If planned improvement was not completed, please provide explanation.)</i>
	opportunities, we will provide additional opportunities for hands-on experiences making solutions in the upper level labs. To more profoundly strengthen student skills, this semester we have already redesigned the introductory chemistry lab modules to make scientific applications of mathematics and lab skills a nexus from which active learning of chemical principals proceed.	been intentional about giving students appropriate assignments designed to improve competency and confidence in basic scientific techniques and lab safety practices.

Provide a response to last year's University Assessment Committee review of the program's learning assessment report:

Comment: Outcome #2 (In a professional setting, students will demonstrate ability to apply knowledge gained from their Biology and Physical Science major): Examples?

Response: The biochemistry laboratory has been completely redesigned to be a more independent learning experience and simulate more 'real world' scientific research. Students gain confidence in experimental design, scientific literacy, lab skills and techniques, and data analysis and presentation. Students are required to draw upon their previous knowledge from other courses to successfully complete each assignment and present their results in a variety of professional manners throughout the course. In addition, we have implemented modules in other courses (introductory biology, genetics, chemistry, etc) that require students to apply knowledge gained from previous courses to better demonstrate the interconnectedness of the curriculum.

Comment: Two questions: Outcome #1: is "and experience" needed? What is "gained knowledge"? Is this knowledge that comes from coursework? This outcome needs some work. Why not consider re-wording as an inquiry outcome without this language? Outcome #3: what do you mean by "basic scientific skills"? Is that just safe lab practices and making solutions? Have you specified anywhere, like in a rubric, what those skills are so that you can see where the strengths and weaknesses are?

Response: As a department we agreed that all of our outcomes needed work and had not been updated in some time. We put a significant effort this past year into defining the hallmarks of a biology/biochemistry degree at Marymount. These hallmarks are represented by our new learning "goals." We then established measurable outcomes for each goal that can be easily assessed by existing tools or tools that we drastically modified (our exit exam). We are interested in feedback from the committee on these new goals and outcomes.

Comment: Described multiple measures (both direct and indirect) for each outcome. Rubrics attached. Appendices provided additional information on measures. The committee re-iterates its comment that it doesn't feel that the target of 60% of students achieve a score of 50% or better is challenging enough. What it says is that the program sets its standard that slightly more than half your graduates achieve a minimum level of proficiency for this outcome.

Response: We have continued our use of multiple measures for each outcome and have attached rubrics where appropriate. We have changed targets based on the new goals and outcomes and would appreciate committee feedback on these new targets.

Comment: Outcome #1 Exit exam measure: Not met. Interpretation of why? Do the exam questions mirror the curriculum? Are the questions reflective of the level of knowledge and skills you expect your students to achieve? If it's not measuring that, you should consider finding another tool. Your students are the GSS express confidence in their skills, but your direct measure, which is the direct observation of those skills, belies that confidence. Indirect measures provide additional information, but the direct measures provide

the most valuable data. If students are scoring at such a low level, what steps is the department taking to correct this problem? Something is not working -- either the exam, or there is a problem with the curriculum. DAT rubric scores: Decrease in scores from third to fourth year. Any speculation as to why? Other years indicated an increase.

Response: We have rewritten the exam exit to more closely assess our new learning goals and outcomes. The new exam is more outcome based as opposed to the purely content-based old exit exam. We first gave the exam in Spring 2018 and realize that the exam will need tweaking and editing based on results but we feel that this will be a better tool moving forward than the exam we had been using. If we continue to experience problems with this new exam or decide that the exit exam in general is not an effective tool, we will certainly explore other assessment options. Additionally, although we feel that our curriculum is strong and effective, we are open to revisions if we can better serve our students.

Comment: Department seems to have used data to make improvements and revise courses within program. You need to address the problem highlighted by the exam results.

Response: Please see previous comments regarding the exit exam. If we continue to experience discrepancies with this tool, we will revisit the use of the exit exam tool in general.

Comment: If a critical part of science education is the ability to read and interpret research reports, then you need to make sure you are assessing this outcome in an effective way. The department needs to have a serious conversation about whether the problem is the curriculum or the exit exam. If the exit exam is not reflective of students' actual skills, then the department should re-consider that tool. You might want to consider using a different tool -- either an external tool like major field tests or an internally developed tool -- to measure these outcomes. But the target needs to be raised -- you need to have as a target that the large majority of your students can demonstrate achievement of this outcome. If, following your assessment, they can't, then the department needs to pay serious attention and take concrete steps. This recommendation has been made repeatedly by the committee, and action needs to be taken this year.

Response: See previous comments regarding the new exit exam. We do realize the limitations of the internally developed tool and realize that adjustments will need to be made following the analysis this first year. We have adjusted our targets to reflect what we feel are reasonable expectations for our students. If students continue to fail to meet these new targets, we will make further adjustments to our assessment measures and/or take a serious look at our curriculum design. Based on our program review results and review of other curriculums, we feel very strongly that we have a rigorous, comprehensive, and cohesive biology and biochemistry curriculum that meets the needs of our students quite well; however, we are open to changes if we can identify areas that need improvement.

During the upcoming 2018-2019 academic year, we will be working to develop assessment tools for independent research experiences and student's ability to read and interpret research reports.

Outcomes Assessment 2017-2018

Goal 1: Students will be able to independently conduct and evaluate scientific research.

Learning Outcome 1: Students can formulate scientifically sound hypotheses

Assessment Activity

Outcome Measures <i>Explain how student learning will be measured and indicate whether it is direct or indirect.</i>	Performance Standard <i>Define and explain acceptable level of student performance.</i>	Data Collection <i>Discuss how the data was collected and describe the student population</i>	Analysis <i>1) Describe the analysis process. 2) Present the findings of the analysis including the numbers participating and deemed acceptable.</i>
Direct: DAT Rubric: (focus and content)	We expect to see an increase in the average DAT scores between first year and fourth year inquiry-based projects. Ratings of excellent receive scores of 4.5-5.0, good received a 3.25-4.5, fair receive 2.0-3.25, and poor receive less than 2.0. Excellent to good scores meet our performance standards.	The designated courses, BIO 151 L General Biology Lab (freshmen), Bio 300 Writing for Science (mid-level students), and BIO 410 Senior Seminar (seniors) all have specific research assignments in which we evaluate designated Discovery Assessment Tool (DAT) elements. See the DAT attachment for the rubric (appendix 2).	1) In the Bio 151 labs, the adjunct instructors were trained on using the DAT to ensure that reliable data could be obtained. Research projects from Bio 151 lab, Bio 300, and Bio 410 were evaluated using the DAT rubric for each individual student. Results were submitted and averages for pertinent sections were compared. For this outcome, we specifically analyzed the 'focus' and 'content' sections of the DAT (see attached appendix 2). Results for the following classes were analyzed Bio 151, Fall 2016 and Fall 2017 (n=68) Bio 300, Fall 2016, Fall 2017, and Spring 2018 (n=81) Bio 410, Spring 2017, Fall 2017, and Spring 2018 (n=42) 2) In the area of "focus," average scores increased from freshman year (Bio 151, 3.35) to junior year (Bio 300, 3.8), to senior year (Bio 410, 4.13). In the area of "content," we see a dramatic increase from 2.9 in Bio 151 to 3.9 in Bio 300, however, that levels off and remains the same in Bio 410 (3.9). Taking these two sections together, we do see average increases in our measures for formulating sound hypotheses from 3.125 (Bio 151) to 3.87 (Bio 300) to 4.02 (Bio 410) (See Appendix 3). Overall, the senior scores are a bit lower than we liked to see. This performance standard was partially met.
Direct: Exit exam questions 1-3, 13, 21	70% of students will achieve a score of 60% or more on the pertinent questions corresponding to each learning outcome of the exit exam. <i>Note: This performance standard has been raised from previous years. The prior standard was 60% of students earning 50% or more.</i>	The newly written exit exam was given to 21 biology students (graduating seniors) in Spring 2018.	1) We administered a newly written exit exam to senior students as part of their Senior Seminar course. The results were analyzed by the Office of Planning and Institutional Effectiveness. The percentage of students who scored at least 60% on each section was calculated. 2) After examining the analysis for individual questions, two questions from this section (Q2 and Q21) were removed from the analysis. Zero of the 21 students answered question 2 correctly, and only 1 of 21 students answered question 21 correctly. These questions will be revised prior to next year's exam. With the removal of these two questions from the analysis, 76.19% of biology majors scored at least

Outcome Measures <i>Explain how student learning will be measured and indicate whether it is direct or indirect.</i>	Performance Standard <i>Define and explain acceptable level of student performance.</i>	Data Collection <i>Discuss how the data was collected and describe the student population</i>	Analysis <i>1) Describe the analysis process. 2) Present the findings of the analysis including the numbers participating and deemed acceptable.</i>
			60% on this section. (2 of the 3 analyzed questions answered correctly). The performance standard was met.
Indirect: Graduating Student Survey, "Apply knowledge and skills to new situations"	70% of GSS respondents perceive their preparation to be good or excellent.	Individual graduating undergraduate seniors answered questions pertaining to their perceptions of their academic preparation and learning outcomes. The University administered and collected the surveys and analyzed the results.	1) A group of professors in the Biology and Physical Sciences Departments obtained the results from the Office of Planning and Institutional Effectiveness and evaluated the data. The mean percent of respondents who answered good or excellent to pertinent questions was calculated. 2) Data from 2016-2017 and 2017-2018 were examined specifically for the "apply knowledge and skills to new situations" question of the GSS. For 16-17, 82.9% of the 35 respondents perceived their preparation as good or excellent. In 17-18, 87.5 of the 24 respondents replied good or excellent to this parameter. This is a total average of 85.2% of the 59 students surveyed believe they are well prepared to apply knowledge and skills to new situations (See Appendix 3). The performance standard was met.
Indirect: Alumni Survey, "Apply knowledge and skills to new situations"	85% of respondents perceive their preparation as good or excellent.	The survey was sent to alumni from the biology programs and data was collected by the Office of Institutional Effectiveness.	1) A group of professors in the Biology and Physical Sciences Departments obtained the results from the Office of Planning and Institutional Effectiveness and evaluated the data. The mean percent of respondents who answered good or excellent to pertinent questions was calculated. 2) Of the 19 respondents (12 from 2015-2016 and 7 from 2011-2012), 89.5% of respondents perceived their preparation as good or excellent in the area of applying knowledge and skills to new situations. The performance standard was met.

Interpretation of Results

Describe the extent to which this learning outcome has been achieved by students (*Use both direct and indirect measure results*): This performance standard was met or partially met in all areas assessed. The overall DAT scores were slightly lower than we like to see and there was no increase from junior to senior year in the 'content' area, but overall, we saw increases that indicate students are achieving the performance standard. We do believe there was some confusion with the use of the DAT in the Bio 410 course, so we will be working this year to rectify that situation and more accurately reflect the abilities of our senior students. There was an anomaly with the exit exam where two questions, believed to be poorly written, were thrown out. With the inclusion of these questions, only 47.6% of students achieved a score of 60% or better. These questions will be revised.

Briefly describe program strengths and opportunities for improvement relative to assessment of outcome: For assessment of this outcome, we plan to revise the two problematic questions (question 2 and 21) from the exit exam. The fact that only 1 student answered either of those two questions correctly indicates that those questions need to be revised or reworded and assessed again. If we continue to see student difficulties in this area, we will explore further the need for programmatic changes. In

addition, we propose adding questions to the GSS and/or alumni surveys specifically asking about student's perception of their ability to formulate scientifically sound hypotheses. We intended to be more intentional about directly measuring this outcome with specific hypothesis formulating questions at all levels of our curriculum.

Discuss planned curricular or program improvements for this year based on assessment of outcome: Since we have included this skill as a core part of our program, we will continue to emphasize the ability to formulate hypotheses in our core curriculum. We will continue to implement and introduce new inquiry learning projects that require students to develop and test scientifically sound hypotheses at all levels of our curriculum.

Learning Outcome 2. Students can design and implement a research project.

Assessment Activity

Outcome Measures <i>Explain how student learning will be measured and indicate whether it is direct or indirect.</i>	Performance Standard <i>Define and explain acceptable level of student performance.</i>	Data Collection <i>Discuss how the data was collected and describe the student population</i>	Analysis <i>1) Describe the analysis process. 2) Present the findings of the analysis including the numbers participating and deemed acceptable.</i>
Direct: DAT Rubric: (Project planning, analysis, and synthesis: Design process)	We expect to see an increase in the average DAT scores between first year and fourth year inquiry-based projects. Ratings of excellent receive scores of 4.5-5.0, good received a 3.25-4.5, fair receive 2.0-3.25, and poor receive less than 2.0. Excellent to good scores meet our performance standards.	The designated courses, BIO 151 L General Biology Lab (freshmen), Bio 300 Writing for Science (mid-level students), and BIO 410 Senior Seminar (seniors) all have specific research assignments in which we evaluate designated Discovery Assessment Tool (DAT) elements. See the DAT attachment for the rubric.	1) In the Bio 151 labs, the adjunct instructors were trained on using the DAT to ensure that reliable data could be obtained. Research projects from Bio 151 lab, Bio 300, and Bio 410 were evaluated using the DAT rubric for each individual student. Results were submitted and averages for pertinent sections were compared. For this outcome, we specifically analyzed the 'design process' sections of the project planning, analysis, and synthesis portion of the DAT (see attached appendix 2). Results for the following classes were analyzed Bio 151, Fall 2016 and Fall 2017 (n=68) Bio 300, Fall 2016, Fall 2017, and Spring 2018 (n=81) Bio 410, Spring 2017, Fall 2017, and Spring 2018 (n=42) 2) Taken together, the average scores increased from freshman year (Bio 151) to junior year (Bio 300), however, the score remained steady from junior to senior year (Bio 410). Respectively, the scores were 3.3, 3.77, and 3.77 (See Appendix 4). This performance standard was partially met.
Direct: Exit exam questions 4-7, 9, and 14-17.	70% of students will achieve a score of 60% or more on the pertinent questions corresponding to each learning outcome of the exit exam. <i>Note: This performance standard has been raised from previous years. The prior standard was 60% of students earning 50% or more.</i>	The newly written exit exam was given to 21 biology students (graduating seniors) in Spring 2018.	1) We administered a newly written exit exam to senior students as part of their Senior Seminar course. The results were analyzed by the Office of Planning and Institutional Effectiveness. The percentage of students who scored at least 60% on each section was calculated. 2) After examining the analysis for individual questions corresponding to this outcome (Q4-7, 9, 14-17), 95.24% of biology majors scored at least 60% on this section. The performance standard was met.
Indirect: Graduating Student Survey: "Conduct research to support a position" "Manage time effectively" "Solve problems in your field using your knowledge and skills"	70% of GSS respondents perceive their preparation to be good or excellent.	Individual graduating undergraduate seniors answered questions pertaining to their perceptions of their academic preparation and learning outcomes. The	1) A group of professors in the Biology and Physical Sciences Departments obtained the results from the Office of Planning and Institutional Effectiveness and evaluated the data. The mean percent of respondents who answered good or excellent to pertinent questions was calculated. 2) Data from 2016-2017 and 2017-2018 were examined specifically for the following parameters: "conduct research to support a

Outcome Measures <i>Explain how student learning will be measured and indicate whether it is direct or indirect.</i>	Performance Standard <i>Define and explain acceptable level of student performance.</i>	Data Collection <i>Discuss how the data was collected and describe the student population</i>	Analysis <i>1) Describe the analysis process. 2) Present the findings of the analysis including the numbers participating and deemed acceptable.</i>
		University administered and collected the surveys and analyzed the results.	position,” “manage time effectively,” and “solve problems in your field using your knowledge and skills.” In regards to conducting research, an average of 76.05% of the 59 respondents (35 from 2016-2017 and 24 from 2017-2018) perceived their preparation as good or excellent. In regards to managing time effectively, 72.55% of the 59 respondents replied positively. Lastly, 85.2% of the 59 respondents perceived their ability to solve problems using knowledge from their field as good or excellent. This is a total average across the two year of 77.93% of students feeling confident in their ability to design and implement research projects in their own fields (See Appendix 4). The performance standard was met.
Indirect: Alumni Survey, “Conduct research to support a position” and “Solve problems in your field using your knowledge and skills.”	85% of respondents perceive their preparation as good or excellent.	The survey was sent to alumni from the biology programs and data was collected by the Office of Institutional Effectiveness.	1) A group of professors in the Biology and Physical Sciences Departments obtained the results from the Office of Planning and Institutional Effectiveness and evaluated the data. The mean percent of respondents who answered good or excellent to pertinent questions was calculated. 2) Of the 18 respondents who answered the question regarding “conduct research to support a position,” only 72.2% responded good or excellent. Of the 19 respondents who answered the question regarding “solve problems in your field...,” 89.5% answered good or excellent. This results in an average of 80.85% of students responding they perceived their preparation as good or excellent in the area of designing and implementing research projects. The performance standard was partially met.

Describe the extent to which this learning outcome has been achieved by students (*Use both direct and indirect measure results*): This performance standard was completely met in 2 of the 4 areas assessed and partially met in two areas. The DAT, one of most reliable direct measures, indicated that our students are not completely meeting this standard. Although we did see a slight increase from year one to year three, the scores from junior and senior projects are below what we like to see and there was no increase in senior year in the average scores. We do believe there was some confusion with the use of the DAT in the Bio 410 course, so we will be working this year to rectify that situation and more accurately reflect the abilities of our senior students. Students, however, did perform well on the exit exam questions relating to this outcome and overall their perception of their preparation was good or excellent.

Briefly describe program strengths and opportunities for improvement relative to assessment of outcome: We feel the newly written exit exam questions are strong assessment tool for this outcome and good measure of our student’s understanding of research design. Questions 4-6 were answered correctly at very high rates (91.7, 91.7, and 95.8 percent, respectively). As this exam undergoes tweaking and revision, we will likely take a look at these questions to ensure they meet the rigorous expectations that we have of our students. We also feel the DAT analysis of inquiry projects is a good measure of our student’s ability to design and implement a research protocol. For future assessment, we propose including a research design question within a course exam/quiz for assessment purposes. In addition, we plan to work on developing assessment tools for our undergraduate research experience that will directly focus on this objective.

Discuss planned curricular or program improvements for this year based on assessment of outcome: Given that this outcome was only partially met, this area will be a focus of ours in the coming year. We will purposefully and intentionally discuss the skills necessary to design appropriate research projects, particularly at freshmen and sophomore levels. Empowered with this additional knowledge and with increased confidence, we predict that, when given the opportunity to put it into practice, junior and senior students will perform better. It is our intention to increase continuity and provide consistent language and skill development across the curriculum. In addition, we hope to involve more students in independent research projects with both faculty and upperclassmen mentors. These experiences will expose students to the skill of designing their own research projects and allow them the opportunity to carry out these projects under supervision.

Learning Outcome 3. Students can analyze data and draw conclusions.

Assessment Activity

Outcome Measures <i>Explain how student learning will be measured and indicate whether it is direct or indirect.</i>	Performance Standard <i>Define and explain acceptable level of student performance.</i>	Data Collection <i>Discuss how the data was collected and describe the student population</i>	Analysis <i>1) Describe the analysis process. 2) Present the findings of the analysis including the numbers participating and deemed acceptable.</i>
Direct: DAT Rubric: (Project planning, analysis, and synthesis: Connections and Conclusions)	We expect to see an increase in the average DAT scores between first year and fourth year inquiry- based projects. Ratings of excellent receive scores of 4.5-5.0, good received a 3.25-4.5, fair receive 2.0-3.25, and poor receive less than 2.0. Excellent to good scores meet our performance standards.	The designated courses, BIO 151 L General Biology Lab (freshmen), Bio 300 Writing for Science (mid-level students), and BIO 410 Senior Seminar (seniors) all have specific research assignments in which we evaluate designated Discovery Assessment Tool (DAT) elements. See the DAT attachment for the rubric.	1) In the Bio 151 labs, the adjunct instructors were trained on using the DAT to ensure that reliable data could be obtained. Research projects from Bio 151 lab, Bio 300, and Bio 410 were evaluated using the DAT rubric for each individual student. Results were submitted and averages for pertinent sections were compared. For this outcome, we specifically analyzed the “connections and conclusions” sections of the project planning, analysis, and synthesis portion of the DAT (see attached appendix 2). Results for the following classes were analyzed Bio 151, Fall 2016 and Fall 2017 (n=68) Bio 300, Fall 2016, Fall 2017, and Spring 2018 (n=81) Bio 410, Spring 2017, Fall 2017, and Spring 2018 (n=42) 2) In the area of “connection among ideas,” average scores increased from freshman year (Bio 151, 3.1) to junior year (Bio 300, 3.7), however, the score remained steady from junior to senior year (Bio 410, 3.7). In the area of “drawing conclusions,” we do see increases across the curriculum from 3.85 in Bio 151 to 3.87 in Bio 300 to 4.1 in Bio 441. Taking both of these measures together, we see overall increases in scores from freshmen to senior students (3.225, 3.785, 3.9), suggesting an improved ability to analyze data and draw conclusions as students moves through the curriculum (see Appendix 5). Overall, the senior scores are a bit lower than we liked to see. This performance standard was partially met.
Direct: Exit exam questions 8, 10, 12, 18-20	70% of students will achieve a score of 60% or more on the pertinent questions corresponding to each learning outcome of the exit exam. <i>Note: This performance standard has been raised from previous years. The prior standard was 60% of students earning 50% or more.</i>	The newly written exit exam was given to 21 biology students (graduating seniors) in Spring 2018.	1) We administered a newly written exit exam to senior students as part of their Senior Seminar course. The results were analyzed by the Office of Planning and Institutional Effectiveness. The percentage of students who scored at least 60% on each section was calculated. 2) After examining the analysis for individual questions corresponding this outcome (Q8,10,12,18-20), only 47.62% of biology majors scored at least 60% on this section. The performance standard was not met.
Indirect: Graduating Student Survey: “Use quantitative and qualitative techniques	70% of GSS respondents perceive their preparation to be good or excellent.	Individual graduating undergraduate seniors answered questions pertaining to their	1) A group of professors in the Biology and Physical Sciences Departments obtained the results from the Office of Planning and Institutional Effectiveness and evaluated the data. The mean percent

Outcome Measures <i>Explain how student learning will be measured and indicate whether it is direct or indirect.</i>	Performance Standard <i>Define and explain acceptable level of student performance.</i>	Data Collection <i>Discuss how the data was collected and describe the student population</i>	Analysis <i>1) Describe the analysis process. 2) Present the findings of the analysis including the numbers participating and deemed acceptable.</i>
within your professional field” “Develop a coherent written argument” “Use technology effectively in a workplace environment”		perceptions of their academic preparation and learning outcomes. The University administered and collected the surveys and analyzed the results.	of respondents who answered good or excellent to pertinent questions was calculated. 2) Data from 2016-2017 and 2017-2018 were examined specifically for the following parameters: “Use quantitative and qualitative techniques within your professional field,” “Develop a coherent written argument” and “Use technology effectively in a workplace environment.” In regards to using techniques, an average of 80.2% of the 59 respondents (35 from 2016-2017 and 24 from 2017-2018) perceived their preparation as good or excellent. In regards to developing a coherent written argument, 74.65% of the 59 respondents replied positively. Lastly, 78.15% of the 59 respondents perceived their ability to use technology effectively as good or excellent. This is a total average across the two year period of 77.67% of students feeling confident in their ability to analyze data and draw conclusions (See Appendix 5). The performance standard was met.
Indirect: Alumni Survey, " “Use quantitative and qualitative techniques within your professional field” “Develop a coherent written argument” “Use technology effectively in a workplace environment”	85% of respondents perceive their preparation as good or excellent.	The survey was sent to alumni from the biology programs and data was collected by the Office of Institutional Effectiveness.	1) A group of professors in the Biology and Physical Sciences Departments obtained the results from the Office of Planning and Institutional Effectiveness and evaluated the data. The mean percent of respondents who answered good or excellent to pertinent questions was calculated. 2) Of the 19 respondents who answered the questions corresponding to this outcome, 84.2% felt their preparation was good or excellent in all three areas. The performance standard was not met.

Describe the extent to which this learning outcome has been achieved by students (*Use both direct and indirect measure results*): This performance standard was not met in 2 of the 4 areas assessed and only partially met in one area. The indirect measure of the graduating student survey was the only measure in which our performance standards were completely met. Our two direct measures fell short of our performance standards with lower than expected scores on the DAT at the junior and senior level and students performing poorly on the exit exam. We do believe there was some confusion with the use of the DAT in the Bio 410 course, so we will be working this year to rectify that situation and more accurately reflect the abilities of our senior students. Overall, students perceive that their preparation was good or excellent based on the GSS and the alumni surveys but they did not meet the rigorous standard to which we expect they should perform.

Briefly describe program strengths and opportunities for improvement relative to assessment of outcome: We feel the exit exam questions are a good assessment tool for this outcome, however, we will revisit these questions, specifically question 19, where only 3 of the 21 biology students correctly answered the question. While we will certainly be evaluating our curriculum in this area, the low percentage might also be an indicator that the question needs to be revised. We feel the DAT is a useful tool and will continue to

use it to assess student's inquiry based projects. The tools we are planning to develop to assess our undergraduate research experiences will be useful in assessing this outcome in the future.

Discuss planned curricular or program improvements for this year based on assessment of outcome: Based on the data presented here, we see that our students are struggling to meet our expectations in regards to data analysis and drawing conclusions. We recognize that these are difficult areas for students to master but we expect that our senior students would score higher in these areas. We will ramp up our focus on these areas specifically, incorporating assignments focusing precisely on these skills and techniques at all levels of our curriculum.

Learning Outcome 4. Students can critically evaluate scientific literature

Assessment Activity

Outcome Measures <i>Explain how student learning will be measured and indicate whether it is direct or indirect.</i>	Performance Standard <i>Define and explain acceptable level of student performance.</i>	Data Collection <i>Discuss how the data was collected and describe the student population</i>	Analysis <i>1) Describe the analysis process. 2) Present the findings of the analysis including the numbers participating and deemed acceptable.</i>
Direct: DAT Rubric: (Information Seeking, Selecting, and Evaluating: Gather the Needed Information and Knowledge, Evaluate Information and Knowledge, and Use of Information and Knowledge)	We expect to see an increase in the average DAT scores between first year and fourth year inquiry- based projects. Ratings of excellent receive scores of 4.5-5.0, good received a 3.25-4.5, fair receive 2.0-3.25, and poor receive less than 2.0. Excellent to good scores meet our performance standards.	The designated courses, BIO 151 L General Biology Lab (freshmen), Bio 300 Writing for Science (mid-level students), and BIO 410 Senior Seminar (seniors) all have specific research assignments in which we evaluate designated Discovery Assessment Tool (DAT) elements. See the DAT attachment for the rubric.	1) In the Bio 151 labs, the adjunct instructors were trained on using the DAT to ensure that reliable data could be obtained. Research projects from Bio 151 lab, Bio 300, and Bio 410 were evaluated using the DAT rubric for each individual student. Results were submitted electronically and averages for pertinent sections were compared. For this outcome, we specifically analyzed the ‘gather the needed information and knowledge,’ ‘evaluate information and knowledge,’ and ‘use of information and knowledge’ sections of the Information seeking, selecting, and evaluating portion of the DAT (see attached appendix 2). Results for the following classes were analyzed Bio 151, Fall 2016 and Fall 2017 (n=68) Bio 300, Fall 2016, Fall 2017, and Spring 2018 (n=81) Bio 410, Spring 2017, Fall 2017, and Spring 2018 (n=42) 2) In the area of “gather the needed information and knowledge,” average scores increased from freshman year (Bio 151, 3.1) to junior year (Bio 300, 3.73), however, the score dropped slightly from junior to senior year (Bio 410, 3.7). In the area of “evaluate information and knowledge,” we do see increases across the curriculum from 3.2 in Bio 151 to 3.7 in Bio 300 to 4.0 in Bio 441. Lastly, in the area of “use of information and knowledge, we see an increase from freshmen (Bio 151, 3.15) to junior year (Bio 300, 3.8), but then we see a slight drop in senior year (Bio 400, 3.6) (See Appendix 6). Taking all of these parameters together, we see increases from freshmen (3.13) to junior (3.74) to senior (3.77) years, suggesting that there is improved ability to evaluate literature as students move through the curriculum (See appendix 6). Overall, the senior scores are a bit lower than we liked to see. This performance standard was partially met.
Direct: Exit exam questions 11,27-30	70% of students will achieve a score of 60% or more on the pertinent questions corresponding to each learning outcome of the exit exam. <i>Note: This performance standard has been raised from previous years. The prior standard was 60% of students earning 50% or more.</i>	The newly written exit exam was given to 21 biology students (graduating seniors) in Spring 2018.	1) We administered a newly written exit exam to senior students as part of their Senior Seminar course. The results were analyzed by the Office of Planning and Institutional Effectiveness. The percentage of students who scored at least 60% on each section was calculated. 2) After examining the analysis for individual questions corresponding this outcome (Q11,27-30), only 9.52% of biology majors scored at least 60% on this section. The performance standard was not met.

Outcome Measures <i>Explain how student learning will be measured and indicate whether it is direct or indirect.</i>	Performance Standard <i>Define and explain acceptable level of student performance.</i>	Data Collection <i>Discuss how the data was collected and describe the student population</i>	Analysis <i>1) Describe the analysis process. 2) Present the findings of the analysis including the numbers participating and deemed acceptable.</i>
Indirect: Graduating Student Survey: "Find appropriate sources of information" "Evaluate the quality of information"	70% of GSS respondents perceive their preparation to be good or excellent.	Individual graduating undergraduate seniors answered questions pertaining to their perceptions of their academic preparation and learning outcomes. The University administered and collected the surveys and analyzed the results.	1) A group of professors in the Biology and Physical Sciences Departments obtained the results from the Office of Planning and Institutional Effectiveness and evaluated the data. The mean percent of respondents who answered good or excellent to pertinent questions was calculated. 2) Data from 2016-2017 and 2017-2018 were examined specifically for the following parameters: "Find appropriate sources of information" and "Evaluate the quality of information." In regards to finding sources, an average of 85.95% of the 59 respondents (35 from 2016-2017 and 24 from 2017-2018) perceived their preparation as good or excellent. In regards to evaluating the quality of information, 82.45% of the 59 respondents replied positively. This is a total average across the two years of 84.2% of students feeling confident in their ability to evaluate sources (See Appendix 6). The performance standard was met.
Indirect: Alumni Survey, " "Find appropriate sources of information" "Evaluate the quality of information"	85% of respondents perceive their preparation as good or excellent.	The survey was sent to alumni from the biology programs and data was collected by the Office of Institutional Effectiveness.	1) A group of professors in the Biology and Physical Sciences Departments obtained the results from the Office of Planning and Institutional Effectiveness and evaluated the data. The mean percent of respondents who answered good or excellent to pertinent questions was calculated. 2) Of the 19 respondents who answered the questions corresponding to this outcome, 89.5% felt their preparation in terms of finding appropriate sources was good or excellent. In regards to evaluating the quality of information, 78.9% of respondents felt their preparation was good or excellent. The performance standard was partially met.

Describe the extent to which this learning outcome has been achieved by students (*Use both direct and indirect measure results*): This performance standard was completely met in one area (indirect) and partially met in two areas (one direct, one indirect). While our students performed well on the DAT, there were some decreases in average scores from junior to senior year that might be explained by improper use of the assessment tool. We will be working this year to make sure everyone is fully trained on using the rubric and change the way the results are reported. Overall, the senior scores were slightly lower than we would like to see. There were significant concerns regarding the exit exam (direct measure) with this outcome. Two questions in particular presented problems for our students with only 3 of the 21 biology students answering the questions correctly. While we will be critically evaluating our curriculum in this area, we will also consider revising these questions before next year. For our indirect measure of the alumni survey, students felt very confident in finding sources but less so in evaluating sources.

Briefly describe program strengths and opportunities for improvement relative to assessment of outcome: We will be focusing our efforts in two main areas in regards to this outcome. First, we will be revising the exit exam questions pertinent to this outcome to clarify the questions and remove ambiguity and/or questions with multiple answers. We will also be retraining all faculty/instructors on the DAT and changing the way the results are reported. We plan to implement a google survey system to ensure that

instructors are entering the data correctly and accurately. We will also be working to become more intentional about the way this outcome is measured and what we mean by evaluating scientific literature. There is some debate over whether we intend to assess the quality of the sources or the content of the sources. This will be a major area of focus in the coming year for us.

Discuss planned curricular or program improvements for this year based on assessment of outcome: Based on the data presented here, we see that our students are struggling mightily to meet our expectations in regards to evaluating and analyzing scientific literature. We recognize that these are difficult areas for students to master but we expect that our senior students would score higher in these areas. We will ramp up our focus on these areas specifically, incorporating assignments focusing precisely on these skills and techniques at all levels of our curriculum.

Overall analysis of goal 1:

Taking all measurable outcomes together for the goal of independently conducting and evaluating scientific research, we fell a bit short of our assessment targets. Upon analysis of this section on the exit exam (questions 1-21, 27-30), 61.9% of our students scored 60% or better (just short of our 70% target).

We also did not see the average scores or increase in scores we expected to see in our DAT analysis. When we take together all of the DAT components pertinent to this goal, we see an average score of 3.175 for Bio 151, 3.77 for Bio 300, and a 3.73 for Bio 410. We recognize there was some confusion with the reporting of DAT scores for Bio 410 but the scores are still slightly lower than we would expect of our senior students. We anticipate that, with more intentional instruction in these outcomes and the improvements we plan to make in our assessment, we will achieve performance standards next year.

Our student's perception of their preparation on the graduating student survey does meet our expectations. Taken together for the past two years, 80% of our students perceive their preparation is good or excellent in areas pertinent to this goal. This exceeds our performance standard of 70% of students reporting good or excellent preparation. While students did not perform as we expected on the direct measures of this goal, we recognize the importance of students being confident in their skills and preparation. We anticipate that, with our planned improvements, student's perceptions will match their performance on the direct measures.

We were just short of our 85% target in terms of alumni reporting good or excellent preparation in regards to this goal. Of the 19 respondents over two years, 84.03% reported good or excellent preparation. We recognize the low response rate in terms of our overall graduates and have been brainstorming as a department on how to improve this rate. We believe that if more of our alumni responded, we might have a more accurate representation of their perceptions.

Given that our exit exam was newly re-written and administered for the first time this Spring, we knew there would be areas that required revision. Our response to this assessment will be two pronged. We will work to revise exit exam questions to more directly assess the desired components and we will continue to incorporate instruction and assignments related to the skills needed for our students to be successful. In addition, we will be working to develop assessment tools for our independent research experiences, which will give us valuable information regarding this goal. Lastly, we will be overhauling the method instructors use to report DAT scores to eliminate confusion associated with the tool. Overall, we feel that we made good strides in achieving our performance targets of this goal and we will be continuing to improve certain areas and maintain our rigorous standards to fully meet our performance targets next year.

Goal 2: Students will be able to demonstrate effective oral and written scientific communication.

Learning Outcome 1: Students can develop coherent written arguments.

Assessment Activity

Outcome Measures <i>Explain how student learning will be measured and indicate whether it is direct or indirect.</i>	Performance Standard <i>Define and explain acceptable level of student performance.</i>	Data Collection <i>Discuss how the data was collected and describe the student population</i>	Analysis <i>1) Describe the analysis process. 2) Present the findings of the analysis including the numbers participating and deemed acceptable.</i>
Direct: DAT Rubric: Final Product: Content	We expect to see an increase in the average DAT scores between first year and fourth year inquiry-based projects. Ratings of excellent receive scores of 4.5-5.0, good received a 3.25-4.5, fair receive 2.0-3.25, and poor receive less than 2.0. Excellent to good scores meet our performance standards.	The designated courses, BIO 151 L General Biology Lab (freshmen), Bio 300 Writing for Science (mid-level students), and BIO 410 Senior Seminar (seniors) all have specific research assignments in which we evaluate designated Discovery Assessment Tool (DAT) elements. See the DAT attachment for the rubric.	1) In the Bio 151 labs, the adjunct instructors were trained on using the DAT to ensure that reliable data could be obtained. Research projects from Bio 151 lab, Bio 300, and Bio 410 were evaluated using the DAT rubric for each individual student. Results were submitted electronically and averages for pertinent sections were compared. For this outcome, we specifically analyzed the content portion of the final product section of the DAT (see attached appendix 2). Results for the following classes were analyzed Bio 151, Fall 2016 and Fall 2017 (n=68) Bio 300, Fall 2016, Fall 2017, and Spring 2018 (n=81) Bio 410, Spring 2017, Fall 2017, and Spring 2018 (n=42) 2) In the area of “content” of the final product average scores increased from freshman year (Bio 151, 3.1) to junior year (Bio 300, 3.8), to senior year (Bio 410, 3.9). (See Appendix 7). While we recognize the overall increase in average scores, the senior scores are a bit lower than we liked to see. This performance standard was partially met.
Indirect: Graduating Student Survey, "Develop a coherent written argument"	70% of GSS respondents perceive their preparation to be good or excellent.	Individual graduating undergraduate seniors answered questions pertaining to their perceptions of their academic preparation and learning outcomes. The University administered and collected the surveys and analyzed the results.	1) A group of professors in the Biology and Physical Sciences Departments obtained the results from the Office of Planning and Institutional Effectiveness and evaluated the data. The mean percent of respondents who answered good or excellent to pertinent questions was calculated. 2) Data from 2016-2017 and 2017-2018 were examined specifically for the “develop a coherent written argument” question of the GSS. For 16-17, 74.3% of the 35 respondents perceived their preparation as good or excellent. In 17-18, 75% of the 24 respondents replied good or excellent to this parameter. This is a total average of 74.65% of the 59 students surveyed believe they are well prepared to develop a coherent written argument (See Appendix 7). The performance standard was met.
Indirect: Alumni Survey, "Develop a coherent written argument."	85% of respondents perceive their preparation as good or excellent.	The survey was sent to alumni from the biology programs and data was	1) A group of professors in the Biology and Physical Sciences Departments obtained the results from the Office of Planning and Institutional Effectiveness and evaluated the data. The mean percent

Outcome Measures <i>Explain how student learning will be measured and indicate whether it is direct or indirect.</i>	Performance Standard <i>Define and explain acceptable level of student performance.</i>	Data Collection <i>Discuss how the data was collected and describe the student population</i>	Analysis <i>1) Describe the analysis process. 2) Present the findings of the analysis including the numbers participating and deemed acceptable.</i>
		collected by the Office of Institutional Effectiveness.	of respondents who answered good or excellent to pertinent questions was calculated. 2) Of the 19 respondents (12 from 2015-2016 and 7 from 2011-2012), 82.4% of respondents perceived their preparation as good or excellent in the area of applying knowledge and skills to new situations. The performance standard was not met.

Interpretation of Results

Describe the extent to which this learning outcome has been achieved by students (Use both direct and indirect measure results): This performance standard was met or partially met in 2 of the 3 areas in which it was assessed. The overall DAT scores were slightly lower than we like to see, particularly in the senior year, but we did observe increases from freshmen to senior year in the 'content' area of the final product. We do believe there was some confusion with the use of the DAT in the Bio 410 course, so we will be working this year to rectify that situation and more accurately reflect the abilities of our senior students. This performance standard was not met among our alumni students with only 82.4% responding their preparation was good or excellent.

Briefly describe program strengths and opportunities for improvement relative to assessment of outcome: As mentioned previously, we will be working to rectify the confusion with the DAT to more accurately reflect the abilities of all our students. Specifically, we will be working to digitize all the reporting of scores so that we are more consistent across the curriculum and individual instructors. We will also seek to add a second direct measure of assessment of this outcome either through project analysis or exam questions.

Discuss planned curricular or program improvements for this year based on assessment of outcome: Writing will continue to be an integral part of our curriculum and we will continue to emphasize scientific writing in all of our courses, not just our WI courses.

Learning Outcome 2: Students can write using current scientific styles.

Assessment Activity

Outcome Measures <i>Explain how student learning will be measured and indicate whether it is direct or indirect.</i>	Performance Standard <i>Define and explain acceptable level of student performance.</i>	Data Collection <i>Discuss how the data was collected and describe the student population</i>	Analysis <i>1) Describe the analysis process. 2) Present the findings of the analysis including the numbers participating and deemed acceptable.</i>
Direct: DAT Rubric: Final Product: Mechanics	We expect to see an increase in the average DAT scores between first year and fourth year inquiry-based projects. Ratings of excellent receive scores of 4.5-5.0, good received a 3.25-4.5, fair receive 2.0-3.25, and poor receive less than 2.0. Excellent to good scores meet our performance standards.	The designated courses, BIO 151 L General Biology Lab (freshmen), Bio 300 Writing for Science (mid-level students), and BIO 410 Senior Seminar (seniors) all have specific research assignments in which we evaluate designated Discovery Assessment Tool (DAT) elements. See the DAT attachment for the rubric.	1) In the Bio 151 labs, the adjunct instructors were trained on using the DAT to ensure that reliable data could be obtained. Research projects from Bio 151 lab, Bio 300, and Bio 410 were evaluated using the DAT rubric for each individual student. Results were submitted electronically and averages for pertinent sections were compared. For this outcome, we specifically analyzed the mechanics portion of the final product section of the DAT (see attached appendix 2). Results for the following classes were analyzed Bio 151, Fall 2016 and Fall 2017 (n=68) Bio 300, Fall 2016, Fall 2017, and Spring 2018 (n=81) Bio 410, Spring 2017, Fall 2017, and Spring 2018 (n=42) 2) In the area of “mechanics” of the final product average scores increased from freshman year (Bio 151, 3.2) to junior year (Bio 300, 3.8), but then we saw a slight decrease in our senior students (Bio 410, 3.6). (See Appendix 8). We did not observe the increase we expected to see for senior student and the senior scores are a bit lower than we liked to see. This performance standard was not met.
Direct: Exit exam questions 36-40	70% of students will achieve a score of 60% or more on the pertinent questions corresponding to each learning outcome of the exit exam. <i>Note: This performance standard has been raised from previous years. The prior standard was 60% of students earning 50% or more.</i>	The newly written exit exam was given to 21 biology students (graduating seniors) in Spring 2018.	1) We administered a newly written exit exam to senior students as part of their Senior Seminar course. The results were analyzed by the Office of Planning and Institutional Effectiveness. The percentage of students who scored at least 60% on each section was calculated. 2) After examining the analysis for individual questions, two questions from this section (Q36 and Q40) were removed the analysis. Zero of the 21 students answered question 40 correctly, and only 1 of 21 students answered question 36 correctly. These questions will be revised prior to next year’s exam. With the removal of these two questions from the analysis, 80.95% of biology majors scored at least 60% on this section. (2 of the 3 analyzed questions answered correctly). The performance standard was met.

Interpretation of Results

Describe the extent to which this learning outcome has been achieved by students (Use both direct and indirect measure results): We used two direct methods to analyze this outcome. The performance standard was met in one of the outcomes and not met in the other. The overall DAT scores were slightly lower than we like to see and there was no increase from junior to senior year in the ‘mechanics’ area, but, we did observe increases from freshmen to junior year that indicate students are making headway toward achieving the performance standard. We do believe there was some confusion with the use of the DAT in the Bio 410 course, so we will be working this year to rectify that

situation and more accurately reflect the abilities of our senior students. There was an anomaly with the exit exam where two questions, believed to be poorly written, were thrown out. With the inclusion of these questions, only 38.1% of students achieved a score of 60% or better. We will be revising these questions prior to exam administration next year so we will have a better representation of our student's abilities in this area.

Briefly describe program strengths and opportunities for improvement relative to assessment of outcome: As mentioned previously, we will be working to rectify the confusion with the DAT to more accurately reflect the abilities of all our students. Specifically, we will be working to digitize all the reporting of scores so that we are more consistent across the curriculum and individual instructors. We will also, as mentioned above, be working to revise the exit exam questions pertinent to this outcome. We will also consider adding a question to the GSS to obtain an indirect measure of student's perceived preparation in this area.

Discuss planned curricular or program improvements for this year based on assessment of outcome: Writing will continue to be an integral part of our curriculum and we will continue to emphasize scientific writing in all of our courses, not just our WI courses. We spend quite a bit of time discussing scientific writing styles in our Bio 300 course but we will work to emphasize this in other courses as well.

Learning Outcome 3: Students can deliver effective oral scientific presentations.

Assessment Activity

Outcome Measures <i>Explain how student learning will be measured and indicate whether it is direct or indirect.</i>	Performance Standard <i>Define and explain acceptable level of student performance.</i>	Data Collection <i>Discuss how the data was collected and describe the student population</i>	Analysis <i>1) Describe the analysis process. 2) Present the findings of the analysis including the numbers participating and deemed acceptable.</i>
Direct: DAT Rubric: average of all elements (except ethics)	We expect to see an increase in the average DAT scores between first year and fourth year inquiry-based projects. Ratings of excellent receive scores of 4.5-5.0, good received a 3.25-4.5, fair receive 2.0-3.25, and poor receive less than 2.0. Excellent to good scores meet our performance standards.	The designated courses, BIO 151 L General Biology Lab (freshmen), Bio 300 Writing for Science (mid-level students), and BIO 410 Senior Seminar (seniors) all have specific research assignments in which we evaluate designated Discovery Assessment Tool (DAT) elements. See the DAT attachment for the rubric.	1) In the Bio 151 labs, the adjunct instructors were trained on using the DAT to ensure that reliable data could be obtained. Research projects from Bio 151 lab, Bio 300, and Bio 410 were evaluated using the DAT rubric for each individual student. Results were submitted electronically and averages for pertinent sections were compared. For this outcome, we average DAT scores with the exception of the ethics section (see attached appendix 1). Results for the following classes were analyzed Bio 151, Fall 2016 and Fall 2017 (n=68) Bio 300, Fall 2016, Fall 2017, and Spring 2018 (n=81) Bio 410, Spring 2017, Fall 2017, and Spring 2018 (n=42) 2) In general, average DAT scores increased from freshman year (Bio 151, 3.25) to junior year (Bio 300, 3.83), to senior year (Bio 410, 3.9). (See Appendix 9). While we recognize the average overall increases, the overall senior scores are a bit lower than we liked to see. This performance standard was partially met.
Direct: Exit exam questions 31-35	70% of students will achieve a score of 60% or more on the pertinent questions corresponding to each learning outcome of the exit exam. <i>Note: This performance standard has been raised from previous years. The prior standard was 60% of students earning 50% or more.</i>	The newly written exit exam was given to 21 biology students (graduating seniors) in Spring 2018.	1) We administered a newly written exit exam to senior students as part of their Senior Seminar course. The results were analyzed by the Office of Planning and Institutional Effectiveness. The percentage of students who scored at least 60% on each section was calculated. 2) After examining the analysis for individual questions corresponding to this outcome (Q31-35), 80.95% of biology majors scored at least 60% on this section. The performance standard was met.
Indirect: Graduating Student Survey: "Deliver a coherent oral presentation"	70% of GSS respondents perceive their preparation to be good or excellent.	Individual graduating undergraduate seniors answered questions pertaining to their perceptions of their academic preparation and learning outcomes. The University administered	1) A group of professors in the Biology and Physical Sciences Departments obtained the results from the Office of Planning and Institutional Effectiveness and evaluated the data. The mean percent of respondents who answered good or excellent to pertinent questions was calculated. 2) Data from 2016-2017 and 2017-2018 were examined specifically for the following parameters: "Deliver a coherent oral presentation." In regards to delivering oral presentations, an average of 85.85% of the 59 respondents (80% of the 35 from 2016-2017 and 91.7% of the

Outcome Measures <i>Explain how student learning will be measured and indicate whether it is direct or indirect.</i>	Performance Standard <i>Define and explain acceptable level of student performance.</i>	Data Collection <i>Discuss how the data was collected and describe the student population</i>	Analysis <i>1) Describe the analysis process. 2) Present the findings of the analysis including the numbers participating and deemed acceptable.</i>
		and collected the surveys and analyzed the results.	24 from 2017-2018) perceived their preparation as good or excellent. (See Appendix 9). The performance standard was met.
Indirect: Alumni Survey, "Deliver a coherent oral presentation."	85% of respondents perceive their preparation as good or excellent.	The survey was sent to alumni from the biology programs and data was collected by the Office of Institutional Effectiveness.	3) A group of professors in the Biology and Physical Sciences Departments obtained the results from the Office of Planning and Institutional Effectiveness and evaluated the data. The mean percent of respondents who answered good or excellent to pertinent questions was calculated. 3) Of the 19 respondents (12 from 2015-2016 and 7 from 2011-2012), 84.2% of respondents perceived their preparation as good or excellent in the area of delivering coherent oral presentations. The performance standard was not met.

Interpretation of Results

Describe the extent to which this learning outcome has been achieved by students (*Use both direct and indirect measure results*): This performance standard was met or partially met in 3 of the 4 areas in which it was assessed. The overall DAT scores were slightly lower than we like to see, particularly in the senior year, but we did observe increases from freshmen to senior year in the overall average scores. We do believe there was some confusion with the use of the DAT in the Bio 410 course, so we will be working this year to rectify that situation and more accurately reflect the abilities of our senior students. Our students performed well on the exit exam for this outcome and our graduating students perceive they are well prepared in the area of oral presentations. This performance standard was not met among our alumni students with only 84.2% responding their preparation was good or excellent (our standard is 85%).

Briefly describe program strengths and opportunities for improvement relative to assessment of outcome: As mentioned previously, we will be working to rectify the confusion with the DAT to more accurately reflect the abilities of all our students. Specifically, we will be working to digitize all the reporting of scores so that we are more consistent across the curriculum and individual instructors. We felt the exit exam questions were an accurate measure of our student's understanding of oral presentation concepts and best practices.

Discuss planned curricular or program improvements for this year based on assessment of outcome: We have students give oral presentations throughout our curriculum and we will continue to emphasize this skill with our students. We will work to provide more immediate and useful feedback and provide opportunities for students to present their independent research as well as classroom research projects.

Overall analysis of goal 2:

Taking all measurable outcomes together for the goal of demonstrating effective oral and written scientific communication, we fell a bit short of our assessment targets. We were however, encouraged by our students performance on the exit exam. Upon analysis of this section on the exit exam (questions 31-40), 80.95% of our students scored 60% or better, which surpasses our target of 70% of students scoring 60% or better.

While we did observe increases in average DAT scores in areas pertinent to this goal from freshmen junior year, those scores leveled off and did not increase in senior years. In addition, the junior and senior scores are a bit lower than we expect to see. When we take together all of the DAT components analyzed for this goal, we see an average score

of 3.18 for Bio 151, 3.81 for Bio 300, and a 3.8 for Bio 410. We recognize there was some confusion with the reporting of DAT scores for Bio 410 but the scores are still slightly lower than we would expect of our senior students. We anticipate that, with more intentional instruction in these outcomes and the improvements we plan to make in our assessment, we will achieve performance standards next year.

Our student's perception of their preparation on the graduating student survey does meet our expectations. Taken together for the past two years, 80.25% of our students perceive their preparation is good or excellent in areas pertinent to this goal. This exceeds our performance standard of 70% of students reporting good or excellent preparation. We recognize the importance of students being confident in their skills and preparation. We anticipate that, with our planned improvements, student's perceptions will match their performance on the direct measures.

We were just short of our 85% target in terms of alumni reporting good or excellent preparation in regards to this goal. Of the 19 respondents over two years, 83.3% reported good or excellent preparation. We recognize the low response rate in terms of our overall graduates and have been brainstorming as a department on how to improve this rate. We believe that if more our alumni responded, we might have a more accurate representation of their perceptions.

Given that our exit exam was newly re-written and administered for the first time this Spring, we knew there would be areas that required revision. Our response to this assessment will be two pronged. We will work to revise exit exam questions to more directly assess the desired components and we will continue to incorporate instruction and assignments related to the skills needed for our students to be successful. In addition, we will be working to develop assessment tools for our independent research experiences, which will give us valuable information regarding this goal. Lastly, we will be overhauling the method instructors use to report DAT scores to eliminate confusion associated with the tool. Overall, we feel that we made good strides in achieving our performance targets of this goal and we will be continuing to improve certain areas and maintain our rigorous standards to fully meet our performance targets next year.