Programmatic Assessment Plan

Program Name: ___Biology_____ Created By: ____Assessment Committee_____ Date: ___5/12/20_____

School of Health and Natural Sciences Mission

The mission of the School of Health and Natural Sciences is to help students develop the skills and habits of mind necessary for scientific inquiry and analysis in their professional, personal and civic lives. Faculty experts and engaged staff in the fields of biology, chemistry, earth and geographic sciences, exercise and sports science, mathematics, physics, psychological science, and nursing support students via foundational learning in the general education curriculum and mastery of content in a variety of majors. Our faculty offer classroom, laboratory, and clinical instruction as well as research opportunities in the sciences and health professions. Faculty and staff collaborate across the University and beyond to offer interdisciplinary learning opportunities.

Department of Biology and Chemistry Mission

The Biology and Chemistry Department believes that every student deserves a first-class education. We are educators at Fitchburg State because our personal values align with the campus values of equity and excellence. We strive to ensure that our students have the best of what we can offer them as they gain an in-depth knowledge of science that is part of a larger interdisciplinary, multicultural liberal arts and sciences education.

In order to achieve our mission, we undertake to:

- Produce students who are well prepared for diverse careers or advanced study in the biological and chemical sciences or related disciplines as well as gain the skills necessary to successfully adapt to future changes within their disciplines.
- Build lasting relationships with students that will advance their professional growth by recognizing the unique needs of each individual and reflecting our passion for engagement in authentic learning experiences.
- Maintain a high level of scholarly activity in a variety of fields associated with biology, chemistry and science education.
- Serve the needs of the university and specific academic departments through our curricular offerings and involvement in the university community.
- Endeavor to demonstrate leadership as stewards of the environment.
- Provide state of the art pedagogical approaches as well as utilize appropriate equipment, technology, and resources for teaching, learning and research in the sciences and science education.
- Work to support the University's mission of providing leadership and support for the economic, environmental, social, and cultural needs of North Central Massachusetts and the Commonwealth.

Part I: Student Learning Outcomes

University Level

ILP Code	Institutional Learning Priorities (ILPs)
ILP 1	**Graduates have a deep understanding of the world.** ***Accomplished through:*** **ILP 1A. Foundational Skills and Disciplinary Breadth** – Students will demonstrate attainment of the Learning Outcomes of the Liberal Arts and Sciences program. **ILP 1B. Mastery in a Defined Body of Knowledge** – Students will attain the specialized academic objectives of their major or program. **ILP 1C. Engagement with Campus and Community** – Students will develop personal and professional skills, goals, and ethical standards of behavior though co-curricular experiences.
ILP 2	**Graduates know how to learn and how to apply their knowledge.** ***Accomplished through:*** **ILP 2A. Creative and Critical Thinking** – Students will use evidence and context to increase knowledge, reason ethically, assess the quality of information, solve problems, and innovate in imaginative ways. **ILP 2B. Effective Communication** – Students will carefully consider and clearly articulate ideas for a range of audiences and purposes in written, spoken, technology-mediated, visual, or other forms of communication. **ILP 2C. Integrative Learning** – Students will apply their breadth and depth of knowledge, skills, and experience to address complex issues.
ILP 3	**Graduates are engaged citizens who demonstrate integrity and continuous personal growth.** ***Accomplished though:*** **ILP 3A. Respect for People and Cultures** – Students will appreciate the contributions and needs of diverse individuals and groups and understand themselves in solidarity with others locally, nationally, and globally. **ILP 3B. Civic Participation in Wider Communities** – Students will demonstrate their ability to work within and across communities, to apply their knowledge in the service of others, and to promote social justice. **ILP 3C. Continuous Learning and Personal Growth** – Students will approach the world with confidence and curiosity, appreciate the complex identities of themselves and others, and reflect critically on their experiences throughout life to make informed choices that advance their own well-being and that of the larger community.

Division Learning Outcomes (DLOs) *

LO Code	Division Student Learning Outcomes	Alignment to LA&S LOs or ELOs
DIV 1	Develop the skills and habits of mind necessary for scientific inquiry and analysis in professional, personal and civic lives.	
DIV 2	Support students via foundational learning in the general education curriculum and mastery of content in a variety of majors.	
DIV 3	Offer classroom, laboratory, and research opportunities in the sciences and health professions.	
DIV 4	Offer interdisciplinary learning opportunities.	

*** These divisional learning outcomes are unofficial. To our knowledge, the school of health and natural sciences has yet to create officially stated learning outcomes. These divisional learning outcomes are derived from the school's mission statement.**

Department Learning Outcomes

LO Code	(Biology) Learning Outcomes (LOs)	Alignment to Division/LA&S LOs or ELOs
PLO 1	*Demonstrate content knowledge of the AAAS BioCore, with topics in:* ● *Evolution* ● *Transformations of Energy and Matter* ● *Information Flow, Exchange and Storage* ● *Structure and Function* ● *Systems*	DIV 1, DIV 2,
PLO 2	***Conduct original biological research***. · *Clearly articulate testable questions and hypotheses* · *Design and execute experiments* · *Analyze data using appropriate statistical methods* · *Summarize data concisely with graphs, tables or images* · *Draw appropriate conclusions* · *Demonstrate safe practices in laboratory and field*	DIV 1, DIV 3
PLO 3	***Communicate science orally and in writing.*** · *Present information in a clear and organized manner* · *Write well-organized and concise reports in a scientifically appropriate style* · *Use relevant technology in communications.* · *Communicate to a general audience*	DIV 2
PLO 4	***Use scientific literature.*** · *Retrieve information efficiently and effectively by searching the biological literature* · *Evaluate scientific articles critically* · *Cite sources appropriately.*	DIV 1

COMMON (Program Name) CORE

	PLO 1	PLO 2	PLO 3	PLO4
General Biology I	1A	1	1	1
General Biology 2	1-2	1	1	1
Ecology	1-2	2	2	2
Genetics	2	2	2	2
Capstone Course	2-3A	3A	3A	3A

0	1	2	3	A
Not Addressed	Introducing	Broadening	Fulfilling	Assessed for Program

Key

- PLO = Program Learning Outcome
- Not Addressed = PLO is not addressed within the specific course
- Introducing = PLO is covered at an introductory level within the specific course
- Broadening = PLO is covered in the course so as to reinforce the students' learning of it within the specific course
- Fulfilling = Demonstration of proficiency of the PLO occurs within the specific course
- Assessed for Program = There will be a Direct Assessment activity to be used in Program Level Assessment in all sections of this course.

Part III: Assessment Measures, Timelines and Targets

Direct Assessment

PLO #	Assessment description (written project, oral presentation with rubric, etc.)	Timing of Assessment	When assessment is to be administered in student program	To which students will assessments administered	What is the target set for the PLO? (criteria for success)
1	Students take a quiz with questions that are mapped to the AAAS BioCore content areas (Evolution, Transformations of Energy and Matter, Information Flow, Exchange and Storage, Structure and Function Systems)	Annual	General Biology I (1st year) & Capstone Course (3rd or 4th year)	A subset of students will be tested. Students enrolled in General Biology I and students enrolled in a subset of capstone courses (e.g Developmental Biology).	For each test question and content area, we measure the % correct answers and the % change from introductory students to capstone students. Our aspirational, "Proficient" target is to see scores of at least 75% correct on every post-test question, OR at least 50% correct with improvement of at least 25% from the pre-test. Because some questions are designed to be challenging and address common misconceptions, we can accept "Sufficient" scores of 50-75% provided there was improvement (5-25%) compared to the pre-test. "Deficient" areas that require discussion at our annual retreat are questions that score <50% in the post-test, OR areas that score 50-75% without any improvement.
2-4	Students complete a poster, oral presentation, or a lab report. Members of the Assessment Committee will evaluate criteria based on a rubric adopted by the department in 2020. The generic rubric will be adapted for each assignment with the help of the course instructor, to guide the Assessment Committee in scoring.	Annual	Capstone Course (3rd or 4th year)	A subset of students enrolled in capstone courses (e.g. Developmental Biology)	A majority of students (>66%) demonstrate sufficiency in one or more of the following areas: A) conducting original research; B) reporting results orally and in writing; and C) using scientific literature effectively.

Indirect Assessment

- Anonymous Student Survey- The Student Affairs Committee will administer an anonymous student survey bi-anually. The Assessment along with the Student Affairs Committees will compile the results and report the findings to the department. Past surveys have not explicitly asked about student perceptions of their skills in our learning outcomes, but we should consider adding that in the future. Identification of strengths and challenges of the Biology program will be discussed at an annual retreat held before the start of the academic year.
- Other indirect methods the committee is considering for the future are (1) measures from SSC and Dashboard data around retention and completion, especially among minority students, (2) survey data from local employers for skills they seek in our majors, and (3) placement data of our graduating students with employment and graduate school.

PART IV: ASSESSMENT CYCLE TIMELINE

Five-Year Assessment Plan

Program Learning Outcome	Year 1	Year 2	Year 3	Year 4	Year 5
Demonstrate content knowledge of the AAAS BioCore, with topics in: ● *Evolution* ● *Transformations of Energy and Matter* ● *Information Flow, Exchange and Storage* ● *Structure and Function* ● *Systems*	X				X
Conduct original biological research.				X	
Communicate science orally and in writing.			X		
Use scientific literature.					X

Part V: Intended Analysis, Responsibility, and Communication

The AY 2019-2020 departmental assessment committee developed this assessment plan. The data created from the assessments described above will be analyzed and evaluated by future members of the assessment committee. The chair (and other members) of the assessment committee will communicate these results at an annual retreat held before the start of the academic year. Feedback from the department at these retreats will be compiled by the assessment committee into an action plan.

APPENDICES:

Capstone Skills Rubric 2020

Capstone Skills Rubric 2020

Rubric to assess skills in Biology majors. Developed from Learning Outcomes (LOs) approved at an August 2019 retreat, and merged with language from a 2014 rubric developed by Assessment Scholars from FSU/MWCC, and from a FSU Chemistry rubric for capstone skills.

- Members of the Assessment Committee will use this rubric to evaluate student projects in Capstone courses, and perhaps mid-level core courses. It is important for course instructors to guide the Assessment Committee to select which of the learning outcomes below (i.e., rows) should be evaluated. Only a subset of learning outcomes would be evaluated in any one year, and certainly with any one project. It will also be necessary for Capstone instructors to define what constitutes specific evidence in their student work for what is proficient, sufficient, or deficient. Data are more useful if the rubric can be tailored to the assignment or project. The Assessment Committee will try to provide results back to the instructor in a timely manner so students can receive feedback, if warranted.
- All faculty are encouraged to select any learning outcome(s) to evaluate a lab report or assignment in any of their classes. If faculty collect such data, please submit results and the project description to the Assessment Committee.
- The Assessment Committee will store the data and summarize the results at each August retreat.
- LO1 is "Demonstrate content knowledge of the AAAS BioCore." We are assessing LO1 with pre- and post-tests with standardized questions. The rubric below is for **assessing skills** that are considered necessary for all Biology majors.

LO2: Conduct original biological research.

	Proficient =3	**Sufficient** =2	**Deficient** =1	**No attempt =0**
2A. Clearly articulate testable questions and hypotheses	Testable and manageable hypothesis clearly stated and explained.	Testable hypothesis somewhat clearly stated and explained. Or the question is not completely manageable within the scale of this project.	Hypothesis not clearly stated and explained. OR Identifies a topic that is far too general and wide-ranging as to be manageable in a student project.	
2B. Design and execute experiments	All elements of the methodology are skillfully developed and described. Experimental treatments address the question without confounding factors. Sample size is appropriate.	Critical elements of the methodology are appropriately developed and described, however, more subtle elements are ignored or unaccounted for (e.g., too few samples).	Description of design demonstrates a misunderstanding of the methodology and/or the basic question addressed.	

2C-1. Summarize results concisely with graphs, tables or images	Skillfully converts relevant information into an insightful portrayal that contributes to a further or deeper understanding.	Portrayal is only partially appropriate or accurate. For example, a graph might be missing units, or the relevance of an image may be unclear.	Portrayal is mostly inappropriate as a way to summarize results.	Only raw data is shown
2C-2. Analyze data using appropriate statistical methods	Skillfully uses statistical summaries or tests for an insightful portrayal that contributes to a further or deeper understanding.	Statistical summary or test is only partially appropriate or accurate.	Portrayal or test is inappropriate or inaccurate.	
2C-3 Use words and sentences to communicate results and describe patterns from data or observations.	Provides thorough and accurate descriptions of patterns or trends in data. Skillfully incorporates statistics into sentences. For example, differences in means are quantified, with units. Or the slope of a line is used to describe a pattern in a graph. Or P-values are included appropriately in the writing.	Provides simple and mostly accurate descriptions of patterns or trends in data. A simple description would be qualitative but not quantitative. Or there are occasional, minor errors in computations, units, etc.	Draws fundamentally incorrect interpretations about what the data mean.	

2D. Draw appropriate conclusions	Uses the results as the basis for thoughtful judgments, drawing insightful, carefully qualified conclusions from this work. Connects and expands on results from different sources, and formulates a coherent argument about a topic. Relates results to appropriate mechanisms (causes). AND/OR Relates appropriate applications or implications from the study.	Uses the results for basic judgments that are correct but lack inspiration or nuance. No attempts to qualify the conclusions, nor to elaborate on mechanisms, nor to consider implications outside this study. OR Minor errors exist in the conclusions.	Conclusions are not appropriate or are clearly incorrect for the results.	May restate a pattern in data/observations, but no attempt is made to draw any conclusions or judgments.
2E. Demonstrate safe practices in laboratory and field	??	??	??	This might be something we do not need to assess with a rubric, or with capstone projects. Instead, we could gather information from assessments already taking place in some classes (Cell, Micro, and Organic Chemistry).

LO3 **Communicate science orally and in writing.**

	Proficient =3	**Sufficient** =2	**Deficient** =1	**No attempt =0**
3A. Write well-organized and concise reports in a scientifically appropriate style	Writing is consistently well-organized, concise, professional, and coherent. Written work follows a publishable format.	Writing is mostly (but not completely) organized, professional, and coherent.	Writing lacks organization or is often not coherent. At least one section of a report is poor: e.g., an Introduction that lacks hypotheses, a Methods written like a recipe, or a missing Results description.	
3B. Present information in a clear and organized manner (Oral presentation or Poster)	Presentation is consistently well-organized, professional, and coherent. Images and text are clearly readable by the audience.	Delivery is mostly (but not completely) organized, professional, and coherent. Images and text are mostly readable.	Presentation lacks organization or is often not coherent. Images and text are often difficult for an audience to read or understand.	
3C. Communicate to a general audience	Poster or presentation could be easily understood by non-experts.	Poster or presentation could be understood by most Biology majors, but non-science majors would struggle to understand the main ideas.	The main ideas of the Poster or presentation could not be understood by people outside of that course.	

LO4 **Use scientific literature**

	Proficient =3	**Sufficient** =2	**Deficient** =1	**No attempt =0**
4A. Retrieve information efficiently and effectively by searching the literature	Retrieves appropriate, focused sources from primary literature. Scholarly review papers are acceptable.	Presents information from relevant sources, but including some less-scholarly sources, or representing limited points of view/approaches.	Presents information from mostly irrelevant sources.	No resources provided when they were expected in the assignment
4B. Evaluate scientific articles critically	Skillfully relates results to recently published literature. Synthesizes in-depth information from a thorough range of relevant sources.	Relates results to published literature, but only enough to fulfill the requirements of the assignment, or some areas of the literature were not considered.	Results or concepts from different sources are included, but there is no (or a very weak) connection to the focus of this study.	
4C. Cite sources appropriately.	All sources are cited in a professional, publishable manner.	Most sources are cited in a professional, publishable manner. A rare mistake might include missing page numbers, for example, or including author initials in the in-text citations.	Most sources are not cited in a professional, publishable manner. For example, commonly missing Journal, volume, or pages. Or omitting author or year in most in-text citations.	