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# Bachelor of Science, Natural Sciences

# Academic Assessment Plan

**Version 4**

**Adopted by**

**The Biological Sciences faculty: 10/13/14**

**Revised and Updated 2/18/2022**

Reviewed with curriculum changes by the Academic Assessment Committee: 4/1/22

Reviewed by the Faculty Senate as an information item: 4/1/22

## Mission Statement

At its core, the Natural Sciences program endeavors to provide students with a foundational background in biology and other core sciences for students wishing to combine the sciences to prepare for a variety of interdisciplinary careers. The Bachelor of Science in Natural Sciences is a degree program that emphasizes the fundamental interrelationships among the sciences. Students master basic natural science principles by engagement in classroom experiences and by conducting research that integrates critical thinking, writing, and speaking in the context of the scientific method. We also recognize that, in the interconnected disciplines of natural sciences, multidisciplinary collaboration is an important mechanism for efficient and successful research and this approach can be equally effective in our teaching.

## Program Student Learning Outcomes

Students graduating with a Bachelor of Science in Natural Sciences will be able to:

(1) Students will design and implement scientific investigations to explore natural phenomena using experimentation, which includes exploration and discovery and testing ideas (gathering and interpreting data).

(2) Students will clearly and accurately communicate scientific ideas, theories, and observations in oral and written forms.

(3) Students will apply scientific data, concepts, and models to craft interdisciplinary explanations of scientific ideas across two of the natural sciences.

### UAA Core Competencies

In addition, UAA has identified four core competencies that all students will develop during their undergraduate careers.

* Effective Communication: The knowledge and skills necessary to engage in effective communication in diverse contexts and formats.
* Creative and Critical Thinking: The knowledge and skills necessary for the critical exploration of issues, ideas, artifacts, and events in order to creatively design, evaluate, and implement a strategy to answer complex questions or achieve a desired goal.
* Intercultural Fluency: The knowledge and skills necessary to promote effective and appropriate interaction in a variety of cultural contexts, particularly in terms of the diverse populations of Alaska.
* Personal, Professional, and Community Responsibility: The knowledge and skills necessary to promote personal flourishing, professional excellence, and community engagement.

## Measures

A description of the tools used in the assessment of the program outcomes and their implementation are summarized in Table 1. The tools and their relationships to the program objectives are listed in Table 2.

There is a separate appendix for each tool that describes the factors that affect the results and give examples of the tools and how they will be implemented.

### Table 1: Assessment Tools and Administration

| Tool | Description | Frequency/Start Date | Collection Method | Administered by |
| --- | --- | --- | --- | --- |
| Tool #1 | Exit Exam: A qualitative measure of learning content and reflection | Fall and Spring Semesters | Qualtrics  | Department Faculty in BIOL A492 |
| Tool #2 | Course artifacts from EL courses evaluated by the Process of Science Rubric | Every third year/Fall 2020 | Artifacts | Assessment Committee |
| Tool #3 | Course artifacts evaluated by the Vision and Change Oral and Written Communication Rubric | Every third year/Fall 2018 | Artifacts | Assessment Committee |

### Table 2: Association of Assessment Tools to Program Objectives

| Student Learning Outcomes | Tool 1 | Tool 2 | Tool 3 |
| --- | --- | --- | --- |
| Students will design and implement scientific investigations to explore natural phenomena using experimentation, which includes exploration and discovery and testing ideas (gathering and interpreting data). | 1 | 1 | 0 |
| Students will clearly and accurately communicate scientific ideas, theories, and observations in oral and written forms. | 0 | 0 | 1 |
| Students will apply scientific data, concepts, and models to craft interdisciplinary explanations of scientific ideas across two of the natural sciences. | 1 | 0 | 1 |

0 = Tool is not used to measure the associated objective.

1 = Tool is used to measure the associated objective.

## Process

(1) *Students will design and implement scientific investigations to explore natural phenomena using experimentation, which includes exploration and discovery and testing ideas (gathering and interpreting data).*

Students submit a variety of assignments such as experimental design, lab reports, data sets, calculations, statistical analyses, and final write-ups in each of the EL: Experiential Learning courses. Such assignments are considered to be evidence artifacts. The ELs were developed based on emergent learning and that means that people are doing real work with skills exchange in a practice application. In multiple courses, students have a voice and choice in how they share their knowledge and learning. Diversity of student interest is noted in the titles/topics of the assignments The assessment committee then uses the Process of Science Rubric to evaluate a sample of the collected artifacts and compare the median and mode between the lower division and upper division ELs to capture student progress in the program.

This PSLO meets UAA Core Competency Creative and Critical Thinking and Personal, Professional, and Community Responsibility

(2) *Students will clearly and accurately communicate scientific ideas, theories, and observations in oral and written forms.*

At a minimum PSLO #2 is evaluated by collecting artifacts from BIOL A108: Principles and Methods in Biology and BIOL A492: Undergraduate Seminar. Examples of artifacts included are analytical research papers, posters, video recordings of oral reports and PowerPoint presentations, and self-evaluations. The committee then scores a subsample of the artifacts using the Vision and Change Oral and Written Communication Rubric. Student learning gains are analyzed by evaluating the rubric scores between BIOL A108 and BIOL A492, with the goal of understanding the student process in attaining this learning objective. When practical artifacts will also be collected from the 200 and 300 level Experiential Learning courses to look at student progress longitudinally.

This PSLO meets the UAA Core Competency Effective Communication.

(3) *Students will apply scientific data, concepts, and models to craft interdisciplinary explanations of scientific ideas across two of the natural sciences*.

In the Natural Sciences, in the semester before they plan to graduate students must submit a final Program of Study-Natural Sciences Degree form signed by their advisor to both the Office of the Registrar and the Department of Biological Sciences. All courses listed in the form must be approved by the formal advisor before submitting the form to the Office of the Registrar and the Department of Biological Sciences. At this time, or in BIOL A492 students take a qualitative exit exam via Qualtrics that allows them to reflect on their academic path.

This PSLO meets the UAA Core Competency Creative and Critical Thinking.

In addition to evaluating the PSLOs for the program, the assessment committee will gather the data on Junior Graduation Rate and Course Pass Rates for students in our program to identify equity gaps and then work with departmental faculty to develop strategies to close those gaps.

### Modification of the Assessment Plan

The faculty, after reviewing the collected data and the processes used to collect it in the fall of each year, will decide whether to alter the assessment process. Changes may be made to any component of the plan, including the objectives, outcomes, assessment tools, or any other aspect of the plan. The assessment program coordinator will oversee the documentation of these changes, if any, and submit the revisions to the faculty for approval. The modified assessment plan will then be forwarded to the dean/director’s office and the Office of Academic Affairs.

## Appendix A: Tools and Descriptions

### Exit Exam Description:

The assessment committee is in the process of creating a qualitative assessment in Qualtrics. Questions are open-ended allowing students to apply concepts from multiple disciplines. The finished survey will be added to this appendix when it is completed.

### Process of Science Rubric:

|  | 4. Mastery | 3. Proficient | 2. Developing | 1. Beginning | 0. Not Applicable |
| --- | --- | --- | --- | --- | --- |
| Formulating Questions and a Hypothesis Statement | Formulates a coherent testable hypothesis that potentially answers the question; completely supported by prior knowledge | Formulates a coherent testable hypothesis that potentially answers the question; partially supported by prior knowledge | Formulates a hypothesis that may not answer the question; supported by opinions and misconceptions | Is not able to formulate a testable hypothesis that answers the question | Not applicable to the assignment |
| Experimentation of Scientific Investigations | Designs and conducts a scientific investigation related directly to the hypothesis; steps are logical and sequential; variables and constants are identified and managed objectively; repeated trials are sufficient to validate results | Designs and conducts a scientific investigation related directly to the hypothesis; steps contain minor inaccuracies in logic and/or sequence; minor inaccuracies in identifying and managing variables and constants do not significantly affect overall results; evidence of repeated trials | Relationship between the hypothesis and the scientific investigation lacks clarity; steps are missing and/or difficult to follow; variables and constants are not properly identified and/or mismanaged and detract from results; trials are insufficient to test hypothesis | Designs and conducts a scientific investigation unrelated to the hypothesis; steps are not logical, not sequential, and/or are vague; variables and constants are missing; no repeated trials | Not applicable to the assignment |
| Quantitative Reasoning: Using Appropriate Tools and Techniques to Collect and Record Data | Effectively chooses/uses appropriate technology and mathematical concepts; data is collected and recorded in a systematic, accurate, and objective manner | Generally chooses/uses appropriate technology and mathematical concepts; minor inaccuracies and some subjectivity in data collection; some inconsistencies present in recording data | Ineffective use of technology and mathematical concepts; errors present in collected data | Ineffective use of technology and mathematical concepts; significant errors or gaps in collected data | Not applicable to the assignment |
| Formulating and Revising Scientific Explanations and Models Using Logic and Evidence | Explanations/models reflect evidence from investigation and are based on accurate science; uses results to verify or refute hypothesis; formulates possible revisions and alternative explanations | Explanations/ models partially reflect evidence from investigation and are based on accurate science; uses results to verify or refute the hypothesis; formulates possible revisions | Explanations/models are based on flawed analysis of data and misconceptions of science; formulates limited revisions | Explanations/models are not based on analysis of data or accurate science; data which refutes the hypothesis is discounted; connections are not present between results and hypothesis; no evidence of possible revision andalternative explanations | Not applicable to the assignment |

### Vision and Change Oral and Written Communication Rubric

|  | 4 - Mastery | 3 - Proficient | 2 - Developing | 1 - Beginning | 0 |
| --- | --- | --- | --- | --- | --- |
| Demonstrates clear & appropriate organization | Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable and is skillful and makes the content of the presentation. | Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable within the presentation. | Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is intermittently observable within the presentation. | Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is not observable within the presentation. | (1) Org |
| Uses clear & suitable language | Language choices are imaginative, memorable, and compelling and enhance the effectiveness of the presentation. Language is appropriate to the audience. | Language choices are thoughtful and generally support the effectiveness of the presentation. Language is appropriate to the audience. | Language choices are mundane and commonplace and partially support the effectiveness of the presentation. Language is appropriate to the audience. | Language choices are unclear and minimally support the effectiveness of the presentation. Language in presentation is not appropriate to the audience. | (2) Lang |
| Incorporates appropriate verbal & nonverbal cues | Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation compelling, and the speaker appears polished and confident. | Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation interesting, and the speaker appears comfortable. | Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation understandable, and the speaker appears tentative. | Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) detract from the understandability of the presentation, and the speaker appears uncomfortable. | (3) Delivery |
| Develops relevant & adequate content | A variety of types of supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that significantly supports the presentation or establishes the presenter's credibility/authority on the topic. | Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that generally supports the presentation or establishes the presenter's credibility/authorityy on the topic. | Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that partially supports the presentation or establishes the presenter's credibility/authority on the topic. | Insufficient supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make reference to information or analysis that minimally supports the presentation or establishes the presenter's credibility/authority on the topic. | (4) SuppMaterial |
| Ability to explain information presented in mathematical forms (e.g., equations, graphs, diagrams, tables, words) | Provides accurate explanations of information presented in mathematical forms. Makes appropriate  inferences based on that information. For example, accurately explains the trend data shown in a graph and makes reasonable predictions regarding what the data suggest about future events. | Provides accurate explanations of information presented in mathematical forms. For instance, accurately explains the trend data shown in a graph. | Provides somewhat accurate explanations of information presented in mathematical forms, but occasionally makes minor errors related to computations or units. For instance, accurately explains trend data shown in a graph, but may miscalculate the slope of the trend line. | Attempts to explain information presented in mathematical forms, but draws incorrect conclusions about what  the information means. For example, attempts to explain the trend data shown in a graph, but will frequently misinterpret the nature of that trend, perhaps by confusing positive and negative trends. |  |
| Ability to make judgments and draw appropriate conclusions based on the quantitative analysis of data, while recognizing the limits of this analysis | Uses the quantitative analysis of data as the basis for deep and thoughtful judgments, drawing insightful, carefully qualified conclusions from this work. | Uses the quantitative analysis of data as the basis for competent judgments, drawing reasonable and appropriately qualified conclusions from this work. | Uses the quantitative analysis of data as the basis for workmanlike (without inspiration or nuance, ordinary) judgments, drawing plausible conclusions from this work. | Uses the quantitative analysis of data as the basis for tentative, basic judgments, although is hesitant or uncertain about drawing conclusions from this work. |  |