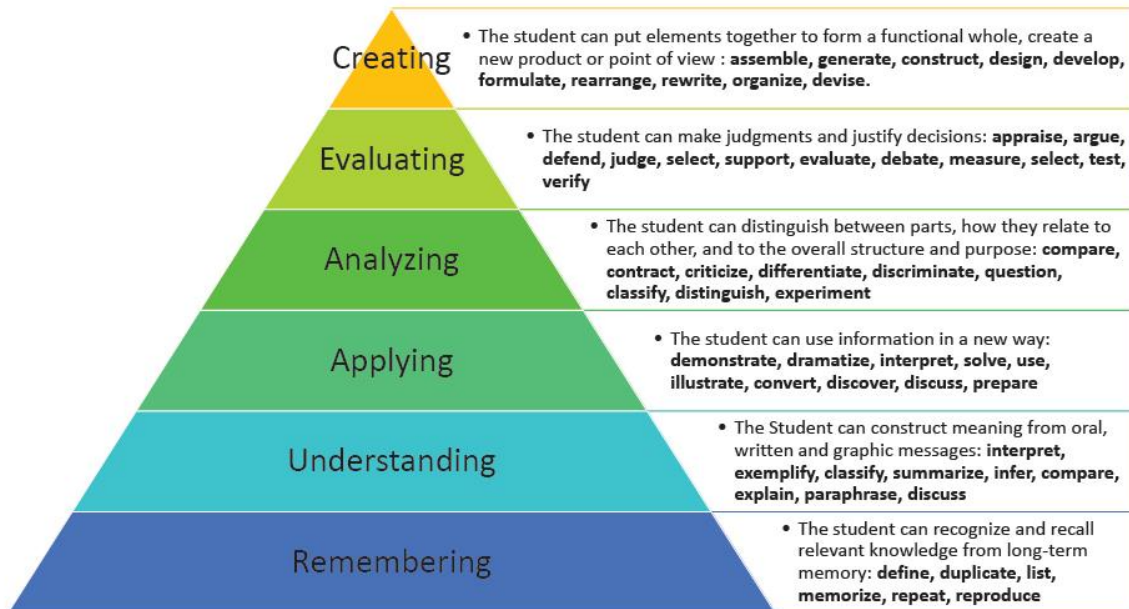


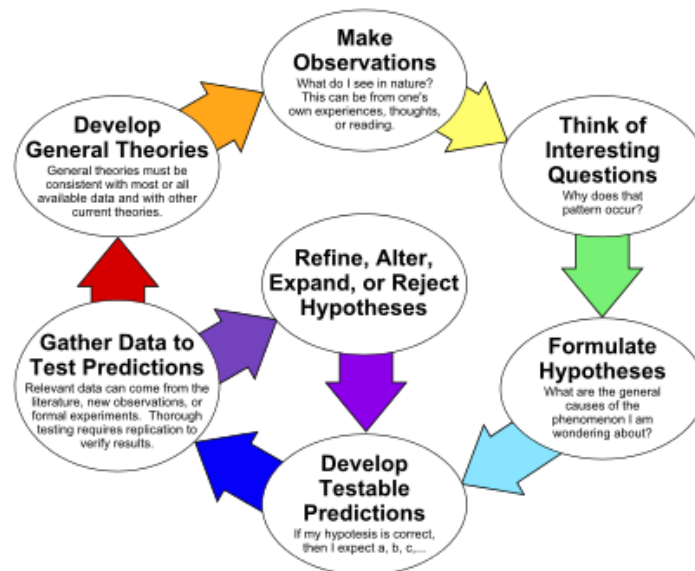
**Learning Outcomes Assessment Planⁱ
Natural & Applied Sciences
Lewiston Auburn College
2016**

The assessment of the learning outcomes achievement of the Natural & Applied Sciences (NAS) Program’s curriculum and its students and graduates rests on the concept of authentic assessment as realized via the application of [Bloom’s Taxonomy](#)¹, Figure 1.



The central approach to scientific discovery, the [Scientific Method](#), makes application of this taxonomy to assess STEM learning practically automatic, Figure 2. This approach to

The Scientific Method as an Ongoing Process



¹ [Bloom, B. S.](#); Engelhart, M. D.; Furst, E. J.; Hill, W. H.; [Krathwohl, D. R.](#) (1956). *Taxonomy of educational objectives: The classification of educational goals. Handbook I: Cognitive domain.* New York: David McKay Company

developing science “fact” via the scientific method is thoroughly described in all introductory NAS courses (see attached checksheet) including Biological Principles I, Principles of Chemistry I, and Anatomy & Physiology I. Students are asked to understand, apply, evaluate, and synthesize new information as they progress through the NAS curriculum. This is most emphatically demonstrated when students co-author scientific presentations and publications with NAS faculty.

The utilization of Bloom’s Taxonomy is immediately apparent in the learning outcomes and goals (objectives) contained in NAS syllabi and their achievement by students as documented by:

- quizzes,
- exams,
- peer tutoring & group work,
- laboratory exercises & practicals,
- essays & research papers,
- research presentations & publications, and
- National Board scores in nursing & occupational therapy.

Representative and progressive examples of the learning objectives are presented below from introductory to advanced NAS course syllabi for Academic Year ’15-’16.

SCI/BIO 105/106 – Biological Principles I

Course Objectives:

- Develop a thorough understanding of fundamental biological concepts including:
 - The building blocks of biological systems and the relationship between structure and function.
 - The flow of biological information within an organism.
- Gain an understanding of science as a process rather than an accumulation of facts.
- Learn about unifying themes within the field of biology.
- Observe a subset of biological concepts in practice.
- Gain personal experience in the process of scientific inquiry, including:
 - Framing questions as hypotheses.
 - Experimental design.
 - Observational skills.
 - Objective analysis.
 - Communication of scientific findings.

Evaluations:

1. Three major examinations
2. Six quizzes
3. Five assignments

4. Three discussion forums- Discussion forums are used for review prior to exams. To receive credit for each forum, you must post at least two questions to the forum by Friday of that week and respond to at least two postings by other students by Sunday night. I will monitor the forums to make sure that student information is correct.
5. Weekly laboratory reports based upon the scientific method

CHY 107 – Chemistry for the Health Sciences

Course Objectives: The ultimate objective of this course is to develop an understanding of the chemical processes involved with living systems, particularly the human body. After first examining fundamental chemical concepts including atomic composition, chemical bonding and chemical forces, and organic chemistry, the goal of the course will be to develop how these concepts relate to biological molecules such as nucleic acids, proteins, lipids, and carbohydrates.

Evaluations:

1. Three major examinations including essays, problem solving, balancing equations, and calculations
2. Three homeworks based on textbook exercises
3. Thirteen quizzes, “*often* based on readings assigned but not yet covered in lecture, as well as the material most recently covered”

SCI 170/171 – Anatomy & Physiology I with Lab

Course Objectives:

Lecture

1. To form a foundation in Anatomy and Physiology that will provide a base of understanding for all future courses you may take. In order to understand how the body is altered in disease, you must understand the normal anatomy and physiology.
2. To explore the form and function of the cell in sufficient detail, so that you will understand the mechanisms of the body system functions and malfunctions at the cellular level.
3. To give you a chance to develop specific knowledge of several body systems.
4. To provide you with the knowledge to express yourself appropriately, both orally and in writing, concerning biological topics.

Laboratory

1. Interact in small groups to practice the language of anatomy
2. Investigate the three dimensional relationships among anatomical structures
3. Examine some of the concepts you discuss in lecture in greater detail
4. Use models, bones, slides and other teaching tools to learn the concepts of anatomy.

Evaluations:

1. Three major examinations

2. Weekly homework based on readings
3. Daily quizzes
4. Three laboratory practicals

SCI/LCC 230 – Environmental Science, Policy, & Sustainability

Course Objectives: Development of ethical citizens with the ability to inquire, interpret, analyze, and evaluate global environmental issues while generating ideas and opinions on solutions to the enormous ecological and societal challenges we currently face.

Evaluations:

1. Three major exams including short answer, multiple choice, and essay questions
2. Field and laboratory exercises and reports assessed on clarity of data collected and presented, comprehension of research concepts and methods
3. Assessment of class discussions on readings and group work on problem sets

SBS/SCI 209 – Human Genetics

Course Objectives: SBS/SCI 209, Human Genetics, is a lecture course designed to introduce the student to modern human genetics. The primary focus of the course is on the role of heredity in human growth, development, behavior, and potential.

Evaluations:

1. Three major essay examinations including calculations of Hardy-Weinberg Equilibria
2. Term paper exploring in-depth a student-selected genetics topic of interest with sufficient clarity and detail to be included in the next iteration of this course

SCI 252 – Medical Microbiology with Lab

Course Objectives:

1. Students will compare metabolic & genetic traits of pathogens and human hosts to appreciate strategies that pathogens use to succeed
2. Students will analyze the various human physiologic responses to pathogens including innate, non-specific, and specific immune responses
3. Students will conduct laboratory exercises to gain proficiency in aseptic technique and the culture and biochemical analysis of bacteria
4. Students will examine the various public health and medical interventions currently in practice to thwart pathogens
5. Students will catalogue the clinical effects of significant established and emerging pathogens

Evaluations:

1. Three major exams with essay, short answer, multiple choice questions, and diagnosis of three cases of bacterial illness taken from the Continuing Medical Education sections of the New England Journal of Medicine
2. Weekly laboratory exercises on the isolation, growth, microscopic and biochemical identification of bacteria species
3. One laboratory practical bacterial unknown assessment

SCI 305 – Molecular Physiology & Laboratory

Course Objectives: This course is a concurrent lab/lecture course that examines the linkage among molecular, cellular, and organismal events. Particular attention is given to DNA replication, signal transduction, and the control of transcription. Additional topics include genomics, proteomics, metabolism, and the compartmentalization of cellular functions.

The laboratories in this course are not “canned”; failures are expected. They will require you to work in groups of three to coordinately complete complex research laboratory tasks in a timely manner. The goal of the laboratory is to provide each student with direct experience with current molecular techniques as evidenced by the successful cloning of a bacterial digestive enzyme and/or marker enzyme (e.g. luciferase). Arrive at each laboratory session with a predetermined research plan. Choreograph your activities so that each experiment can be completed and documented. Laboratory exercises may extend into the lecture time period. My goal for this course is to engage in a cooperative learning experience focused on molecular physiology and to continue to improve this course offering by developing our own laboratory manual.

Evaluations:

1. Two, take-home essay examinations
2. Six laboratory reports including hypothesis, materials & methods, data collection and analysis, and summary conclusions
3. Class production of a consensus laboratory manual

SCI 315 – Environmental Health

Course Objectives:

1. To increase awareness, appreciation, and practice of our roles as global citizens of a planet with limited resources and capacities
2. To learn research techniques for examining formal, scholarly literature pertaining to complex and challenging topics
3. To polish writing, critical thinking, and analysis skills
4. To gain experience and confidence in presenting and discussing your research-derived conclusions

5. To evolve a personal pathway for a responsible, fruitful, and sustainable life on this planet

Evaluations:

Development and submission of four scholarly essays based on scientific, peer-reviewed published research on:

1. Essay #1- Global Environmental Health Concern
2. Essay #2- Regional (continent, ocean, hemisphere) Environmental Health Concern
3. Essay #3- Local (nation, national region, state, city/town) Environmental Health Concern
4. Essay #4- Personal Environmental Health Plan (how you will improve your personal environment to promote and sustain your health)

OTH 514 – Human Anatomy: Structure & Function

Course Objectives:

1. To provide a foundation of the necessary knowledge of normal anatomy, upon which the future occupational therapist can build to better understand how to deal with the abnormal states with which they will be faced.
2. To provide the anatomical knowledge, so that the occupational therapist can understand the diseased state and then be able to make appropriate recommendations for compensation or modification for that condition.
3. To provide the occupational therapist with the means of expressing themselves in proper anatomical terms to be able to communicate their findings and recommendations for treatment in scientific anatomical terminology to other professionals.
4. Provide knowledge of sectional anatomy in order to correlate this with imaging techniques.
5. To provide a background for scientifically related courses they will be taking in the future.

Evaluations:

1. Three major lecture examinations
2. Daily quizzes
3. Three laboratory practical exams
4. Weekly laboratory reports

Present Status

At this time, the NAS Program requires administrative and IT support to collect and analyze the learning outcomes assessment data in the entire NAS curriculum. Such support would allow us to drill down into the data on myriad determinants of student success.

¹ This plan was assembled by NAS Program Director Blake Whitaker in consultation and cooperation with NAS faculty & staff and the support of Dean Joyce Gibson