

Ohio Transfer Module Natural Sciences (Revised and Endorsed – April 25, 2017)

Learning Outcomes:

The course directly emphasizes at least one of the learning outcomes for the Transfer Module. Which of these learning outcomes are addressed and how?

- a. *Communicate effectively*: All general education programs include a component for writing; many also include a component for oral communication or presentation
- b. *Evaluate arguments in a logical fashion*: Competence in analysis and logical argument are explicit learning goals for most general education programs, although these skills go by a variety of names (e.g., critical thinking, analysis, logical thinking, etc.)
- c. *Employ the methods of inquiry characteristic of natural sciences, social sciences, and the arts and humanities*: The tools for solving problems vary across disciplines; general education introduces students to methods of inquiry in several fields of study and thereby prepares students to integrate information from different disciplines
- d. *Acquire an understanding of our global and diverse culture and society*
- e. *Engage in our democratic society*: One of the overarching goals of general education is to prepare students to be active and informed citizens, the development of a disposition to participate in and contribute to our democracy is full of equal importance to the goal of having the skills to do so intelligently.

Guideline 1: The course has the required entry level college proficiencies appropriate to the course. Entry level college proficiencies can be shown using a variety of means including placement exams, prerequisite coursework and a description of the course materials.

Guideline 2: Course is not remedial or developmental.

Guideline 3: Course does not cover variable content from term to term.

Guideline 4: Course is not a special topics course.

Guideline 5: Course is not an upper division course.

Guideline 6: Course is not a narrowly-focused technical or pre-technical course.

Guideline 7: Course is an introductory course that makes clear the importance of experimental inquiry in the sciences and the way in which such inquiry into the natural world leads scientists to formulate principles that provide universal explanations of diverse phenomena.

Guideline 8: Course helps the students to develop an understanding of structured thinking involving induction and deduction.

Guideline 9: Course is from natural science disciplines such as astronomy, biology, chemistry, environmental science, geology, physical geography or physics.

Guideline 10: The course has as a goal the development of an understanding of how scientific principles are built and used in the modern world and of the impact of science on society.

Guideline 11: The course does not focus exclusively on content coverage, without addressing the learning outcomes for the Transfer Module.

Guideline 12: Course has a laboratory component that has at least one credit hour and at least 1,500 minutes of laboratory activities (an average of no less than two hours per week for a traditional fifteen-week semester).

Guideline 13¹: The laboratory component of the course achieves the following learning objectives in the equivalent of at least 10 weeks (~2/3) of the course's "laboratory activities":

- involves realistic measurements of physical quantities;
- involves data analysis, using data that are unique and/or physically authentic and that includes random and/or systematic (natural) variability;
- includes realistic interactions with experimental apparatus, and realistic manipulation of tools/ instruments and/or observed objects in space and time;
- involves synchronous feedback² on safety (and consequences of unsafe actions), correctness of procedure, and progress toward experimental goals; and
- involves effective interaction with the instructor at several points during each lab activity.

Footnotes for Guideline 13:

- Some disciplines, such as astronomy, meteorology, and ecology, are more amenable to achieving a quality virtual educational laboratory experience. By contrast, other disciplines, such as chemistry*, microbiology, and physics, are much less likely to meet the expectations of an OTM natural sciences laboratory course if focused heavily on virtual laboratory experiences. [*The American Chemical Society has released a Position Statement on this issue: <https://www.acs.org/content/acs/en/policy/publicpolicies/education/computersimulations.html>]*
- Synchronous feedback on safety could be achieved using sophisticated computational approaches or by actual instructor feedback.*