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11/14/2008 Attending: Chris, Kathy A., Kathleen D., Karen, Gillian, Marc, Marnie, Frank, Allison

NATURAL SCIENCES

Natural science courses deal with the physical universe, the testable principles that govern its operations, its life forms, and its natural, measurable phenomena. One primary purpose of these courses is to promote an awareness of the methods of scientific inquiry and the power of scientific inquiry to describe the natural world. Emphasis is on understanding and applying the scientific method, which promotes a sense of discovery, fosters critical analysis, and encourages an understanding of the relationships between science and other human activities. A GE natural science course should exhibit the same methods and skills used by scientists when seeking an understanding of the uncertainty and complexity of the natural world.

A successful GE natural science course **must** promote in students:

N1. An understanding of the scientific method, including its attributes and limitations.
N2. The ability to make judgments regarding the validity of scientific evidence.
N3. An understanding of the relationship between hypothesis, experiment, fact, theory and law.
N4. The ability to use inductive and deductive reasoning.
N5. The practice of thinking critically, including evaluating ideas and contrasting opinions.
N6. The ability to evaluate, use and communicate scientific data.
N7. An introduction to current scientific theories within the field of study.
N8. Experience with laboratory activities using lab techniques consistent with those employed within the discipline.
N9. Experience applying recognized scientific methodology in laboratory activities.*

Additional criterion thought to enhance a natural science course include any of the following:

N10. An appreciation of the contributions of science to modern life.
N11. An appreciation of the contributions to science of diverse people and cultures.
N12. An understanding of the interdependence of humans and their environment.
N13. A recognition of how human behavior has altered the environment.
N14. A sense of the history of science and the ideas and experiments that have led to our present understanding.

Be advised that the following criteria for a GE lab is consistent with a definition provided by the National Research Council, 2005

> Laboratory experiences provide opportunities for students to interact directly with the material world (or with data drawn from the material world), using the tools, data collection techniques, models, and theories of science. This definition includes student interaction with astronomical databases, genome databases, databases of climatic events over long time periods, and other large data sets derived directly from the material world. It does not include student manipulation or analysis of data created by a teacher to simulate direct interaction with the material world. For example, if a physics teacher presented students with a constructed data set on the weight and required pulling force for boxes pulled across desks with different surfaces and asked them to analyze these data, the students' problem-solving activity would not constitute a laboratory experience in the committee's definition.

* To accomplish these goals a laboratory course **must** emphasize the methods of scientific inquiry by engaging **students** in:

NL1. Observation and collection of data through direct interaction with the material world.
NL2. Use of tools, data collection techniques, models and theories of science most prevalent in relevant research laboratories.
NL3.Data may be from large data sets derived directly from the material world, but may not rely exclusively on student manipulation or analysis of data created by a teacher to simulate direct interaction with the material world.
NL4. Analysis and interpretation of data.
NL5. Formulation and testing of hypotheses.
NL6. Communicating effectively through oral and/or written work.

NL7. A minimum of one collaborative activity.
NL8. A minimum of one lab unit or the equivalent of 33 hours of laboratory instruction per quarter.

* Additional criterion thought to enhance a natural science lab include any of the following:
NL9. Keep accurate and complete experimental records.
NL10. Perform quantitative and qualitative measurements.
NL11. Interpret experimental results and draw reasonable conclusions.
NL12. Analyze data statistically and assess the reliability of results.
NL13. Critically evaluate the design of an experiment.
NL14. Design experiments to test hypotheses.
NL15. Work effectively in small groups and teams.