

Appendix K: Hands-On Science Category Course Submission Requirements and Evaluation Criteria and Rubrics

COURSE SUBMISSION REQUIREMENTS

Minimum Required Materials for GEOC Review (per GEOC Standing Rules):

1. Cover Letter/Rationale/Justification
 - a. Rationale must include sound justification as to why this course meets the requirements for the Hands-On Science category. The originator must demonstrate how the course will teach to and assess the Student Learning Outcomes assigned to the Hands-On Science category.
 - i. Quantitative Reasoning: Students will be able to interpret models and/or solve quantitative problems from different contexts with real-world relevance; create and communicate reasonable arguments supported by quantitative evidence; and clearly communicate those arguments in effective formats (e.g., using words, tables, graphs, and mathematical equations).
 - ii. Scientific Reasoning: Students will be able to identify and use empirical evidence to describe/explain and predict natural phenomena through application of the scientific method; and use scientific principles to design, evaluate, and implement strategies to answer open-ended questions.
 - iii. Knowledge of the Physical World: Students will be able to describe some of the major concepts in science to explain natural phenomena; and evaluate the quality of scientific information on the basis of methods used to generate it.
 - b. Hands-On Science category-specific list of criteria follow.
2. Course Syllabus
3. Example Assignment(s)
4. Example Assessment(s)

Minimum Rubric Evaluation Criteria for SLOs (per GEOC Standing Rules):

Quantitative Reasoning	Interpret models and/or solve quantitative problems from different contexts with real-world relevance
	Create reasonable arguments supported by quantitative evidence
	Communicate reasonable arguments supported by quantitative evidence in effective formats
Scientific Reasoning	Identify and use empirical evidence to describe/explain natural phenomena through application of the scientific method
	Identify and use empirical evidence to predict natural phenomena through application of the scientific method
	Use scientific principles to design strategies to answer open-ended questions
	Use scientific principles to evaluate strategies to answer open-ended questions
Knowledge of the Physical World	Describe some of the major concepts in science to explain natural phenomena
	Evaluate the quality of scientific information on the basis of methods used to generate it

HANDS-ON SCIENCE CATEGORY-SPECIFIC MATERIALS/RESPONSES:

In addition to the minimum required materials, the syllabus should be highlighted and annotated to show how the course meets the course description and provides students with opportunities to achieve associated SLOs.

1. Complete the Criteria Worksheet, providing evidence of student engagement with SLOs and descriptions of assessment types (150-word limit for each response).

Note: These tables are provided here for planning purposes. The last three columns will be available as fillable fields in Curriculog.

Criteria Worksheet: Hands-On Science

Required of All Courses			
Criteria: Students will ...	Evidence of Student Engagement	Assessment Types	Description
Demonstrate the ability to complete hands-on science by making observations, understanding fundamental scientific design, generating and analyzing data using quantitative tools, use abstract reasoning to interpret data and mathematical models or formula, test scientific hypotheses. Hands-on aspects of course design may include traditional laboratory-based experiences, field experiences, studio work, recitations, clinical application, or other appropriate experiences for the setting/discipline.			

SLO: Quantitative Reasoning			
Complete at the least the FIRST THREE of the following			
Criteria: Students will ...	Evidence of Student Engagement	Assessment Types	Description
a) Interpret models and/or solve quantitative problems from different contexts with real world relevance.			
b) Create reasonable arguments supported by quantitative evidence (e.g., using words, tables, graphs, and/or mathematical equations).			
c) Communicate reasonable arguments supported by quantitative evidence (e.g., using words, tables, graphs, and/or mathematical equations).			
d) Demonstrate a variety of mathematical principles and the methods of data analysis.			
e) Students will apply or demonstrate the use of quantitative analyses in a variety of different contexts to construct explanations and/or solve problems.			

SLO: Scientific Reasoning**Complete at the least the FIRST FIVE of the following**

Criteria: Students will ...	Evidence of Student Engagement	Assessment Types	Description
a) Identify and use empirical evidence to <i>describe/explain</i> natural phenomena through application of a scientific method.			
b) Identify and use empirical evidence to <i>predict</i> natural phenomena through application of a scientific method.			
c) Use scientific principles to <i>design</i> strategies to answer open-ended questions.			
d) Use scientific principles to <i>evaluate</i> strategies to answer open-ended questions.			
e) Use scientific principles to <i>implement</i> strategies to answer open-ended questions.			
f) Critically evaluate scientific arguments and identify the limits of scientific knowledge.			
g) Explore complex questions and identify how they impact or are impacted by external issues (political, economic, or ethical).			
h) Solve or demonstrate resolutions to complex questions or problems requiring the application of scientific concepts.			
i) Communicate scientific ideas effectively.			

SLO: Knowledge of the Physical World**Complete at the least the FIRST THREE of the following**

Criteria: Students will ...	Evidence of Student Engagement	Assessment Types	Description
a) Describe some of the major concepts in science to explain natural phenomena.			
b) Evaluate the quality of scientific information on the basis of methods used to generate it.			
c) Use qualitative and/or quantitative analyses to draw inferences or conclusions from data.			

d) Explore complex questions and identify how they impact or are impacted by external issues (political, economic, or ethical).			
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COURSE PROPOSAL EVALUATION CRITERIA AND RUBRICS

GEOC Advisory Subcommittee members will use the following rubrics when reviewing and providing feedback on faculty submissions for Hands-On Science.

Criteria Checklist Rubric: To be completed by the subcommittee

Required of All Courses

Criteria: Students will ...	Course Meets Criteria?	Comments
Demonstrate the ability to complete hands-on science by making observations, understanding fundamental scientific design, generating and analyzing data using quantitative tools, use abstract reasoning to interpret data and mathematical models or formula, test scientific hypotheses.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Unclear	

QUANTITATIVE REASONING: COURSE MUST MEET AT LEAST THE FIRST THREE OF THE FOLLOWING

Criteria: Students will ...	Course Meets Criteria?	Comments
a) Interpret models and solve quantitative problems from different contexts with real world relevance.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Unclear	
b) Create reasonable arguments supported by quantitative evidence (e.g., using words, tables, graphs, and/or mathematical equations).	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Unclear	
c) Communicate reasonable arguments supported by quantitative evidence (e.g., using words, tables, graphs, and/or mathematical equations).	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Unclear	
d) Demonstrate a variety of mathematical principles and methods of data analysis.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Unclear	
e) Students will apply or demonstrate the use of quantitative analyses in a variety of different contexts to construct explanations and/or solve problems.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Unclear	
Total number of QUANTITATIVE REASONING criteria met by course proposal:		/5

SCIENTIFIC REASONING: COURSE MUST MEET AT LEAST THE FIRST FIVE OF THE FOLLOWING

Criteria: Students will ...	Course Meets Criteria?	Comments
a) Identify and use empirical evidence to <i>describe/explain</i> natural phenomena through application of a scientific method.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Unclear	
b) Identify and use empirical evidence to <i>predict</i> natural phenomena through application of a scientific method.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Unclear	
c) Use scientific principles to <i>design</i> strategies to answer open-ended questions.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Unclear	
d) Use scientific principles to <i>evaluate</i> strategies to answer open-ended questions.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Unclear	
e) Use scientific principles to <i>implement</i> strategies to answer open-ended questions.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Unclear	
f) Critically evaluate scientific arguments and identify the limits of scientific knowledge.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Unclear	
g) Explore complex questions and identify how they impact or are impacted by external issues (political, economic, or ethical).	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Unclear	
h) Solve or demonstrate resolutions to complex questions or problems requiring the application of scientific concepts.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Unclear	
i) Communicate scientific ideas effectively.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Unclear	
Total number of SCIENTIFIC REASONING criteria met by course proposal:		/9

KNOWLEDGE OF THE PHYSICAL WORLD: COURSE MUST MEET AT LEAST THREE INCLUDING THE FIRST TWO OF THE FOLLOWING

Criteria: Students will ...	Course Meets Criteria?	Comments
a) Describe some of the major concepts in science to explain natural phenomena.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Unclear	
b) Evaluate the quality of scientific information on the basis of methods used to generate it.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Unclear	
c) Use qualitative and/or quantitative analyses to draw inferences or conclusions from data.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Unclear	

d) Explore complex questions and identify how they impact or are impacted by external issues (political, economic, or ethical).	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Unclear	
Total number of KNOWLEDGE OF THE PHYSICAL WORLD criteria met by course proposal:		/4

COURSE DESCRIPTION & OBJECTIVES

Based on the course syllabus, assign an appropriate rating to course description and objectives in relation to the required Student Learning Outcomes.

5 Description and objectives show an exceptional emphasis on the required student learning outcomes.	4 Description and objectives show a clear emphasis on the required student learning outcomes.	3 Description and objectives adequately address the required student learning outcomes.	2 Description and objectives make limited reference to the required student learning outcomes.	1 Description and objectives make no reference to the required student learning outcomes.
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COURSE FOCUS

Based on the course syllabus, assign an appropriate rating to the course focus by determining what percentage of the course content deals with the required Student Learning Outcomes.

5 90-100% of the course appears to be related to the student learning outcomes	4 80-89% of the course appears to be related to the student learning outcomes	3 70-79% of the course appears to be related to the student learning outcomes	2 50-69% of the course appears to be related to the student learning outcomes	1 0-49% of the course appears to be related to the student learning outcomes
100%	90%	80%	70%	0%

EVIDENCE OF STUDENT LEARNING

Based on the following Criteria Checklist, assign an appropriate rating to course assessments in relation to the required Student Learning Outcomes.

5 Assessments far exceed the minimum requirements for ensuring student learning outcomes.	4 Assessments exceed the minimum requirements for ensuring student learning outcomes.	3 Assessments meet the minimum requirements for ensuring student learning outcomes.	2 Assessments do not meet the minimum requirements for ensuring student learning outcomes.	1 Assessments need significant improvement to ensure student learning outcomes.
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Final remarks and decision, to be completed by the subcommittee:

- Accept the course, as submitted, for Hands-On Science.
- Suggested revisions to meet Hands-On Science requirements: