

# Hands-On Science

## Proposal and Evaluation Procedures

**Required Proposal Materials:** In order for a course proposal to be evaluated for this General Education category, the Subcommittee *must* be provided with:

- Completed Course Information Worksheet
- Course Syllabus
- Completed Criteria Worksheet

**Course Proposals will be evaluated based on:**

- Course Description & Objectives
- Course Focus
- Evidence of Student Learning

**CRITERIA WORKSHEET: HANDS-ON SCIENCE**  
(to be completed by faculty applicant)

**REQUIRED OF ALL COURSES**

<b>Criteria:</b> Students will...	<b>Evidence of Student Engagement</b>	<b>Assessment Types</b>	<b>Description</b>
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.	<i>150 word limit</i>		<i>150 word limit</i>

**QUANTITATIVE REASONING: COMPLETE AT LEAST THE FIRST THREE OF THE FOLLOWING**

<b>Criteria:</b> Students will...	<b>Evidence of Student Engagement</b>	<b>Assessment Types</b>	<b>Description</b>
a) Interpret models and solve quantitative problems from different contexts with real world relevance.	<i>150 word limit</i>		<i>150 word limit</i>
b) Create reasonable arguments supported by quantitative evidence (e.g., using words, tables, graphs, and/or mathematical equations).	<i>150 word limit</i>		<i>150 word limit</i>
c) Communicate reasonable arguments supported by quantitative evidence (e.g., using words, tables, graphs, and/or mathematical equations).	<i>150 word limit</i>		<i>150 word limit</i>
d) Demonstrate a variety of mathematical principles and the methods of data analysis.	<i>150 word limit</i>		<i>150 word limit</i>
e) Students will apply or demonstrate the use of quantitative analyses in a variety of different contexts to construct explanations and/or solve problems.	<i>150 word limit</i>		<i>150 word limit</i>

**SCIENTIFIC REASONING: COMPLETE AT LEAST THE FIRST FIVE OF THE FOLLOWING**

<b>Criteria: Students will...</b>	<b>Evidence of Student Engagement</b>	<b>Assessment Types</b>	<b>Description</b>
a) Identify and use empirical evidence to <i>describe/explain</i> natural phenomena through application of a scientific method.	<i>150 word limit</i>		<i>150 word limit</i>
b) Identify and use empirical evidence to <i>predict</i> natural phenomena through application of a scientific method.	<i>150 word limit</i>		<i>150 word limit</i>
c) Use scientific principles to <i>design</i> strategies to answer open-ended questions.	<i>150 word limit</i>		<i>150 word limit</i>
d) Use scientific principles to <i>evaluate</i> strategies to answer open-ended questions.	<i>150 word limit</i>		<i>150 word limit</i>
e) Use scientific principles to <i>implement</i> strategies to answer open-ended questions.	<i>150 word limit</i>		<i>150 word limit</i>
f) Critically evaluate scientific arguments and identify the limits of scientific knowledge.	<i>150 word limit</i>		<i>150 word limit</i>
g) Explore complex questions and identify how they impact or are impacted by external issues (political, economic, or ethical).	<i>150 word limit</i>		<i>150 word limit</i>
h) Solve or demonstrate resolutions to complex questions or problems requiring the application of scientific concepts.	<i>150 word limit</i>		<i>150 word limit</i>
i) Communicate scientific ideas effectively.	<i>150 word limit</i>		<i>150 word limit</i>

**KNOWLEDGE OF THE PHYSICAL WORLD: COMPLETE AT LEAST THREE (INCLUDING THE FIRST TWO) OF THE FOLLOWING**

<b>Criteria: Students will...</b>	<b>Evidence of Student Engagement</b>	<b>Assessment Types</b>	<b>Description</b>
-----------------------------------	---------------------------------------	-------------------------	--------------------

a) Describe some of the major concepts in science to explain natural phenomena.	<i>150 word limit</i>		<i>150 word limit</i>
b) Evaluate the quality of scientific information on the basis of methods used to generate it.	<i>150 word limit</i>		<i>150 word limit</i>
c) Use qualitative and/or quantitative analyses to draw inferences or conclusions from data.	<i>150 word limit</i>		<i>150 word limit</i>
d) Explore complex questions and identify how they impact or are impacted by external issues (political, economic, or ethical).	<i>150 word limit</i>		<i>150 word limit</i>

**CRITERIA CHECKLIST: SOLUTIONS THROUGH SCIENCE**  
(to be completed by evaluator)

**REQUIRED OF ALL COURSES**

<b>Criteria:</b> Students will...	<b>Course Meets Criteria?</b>	<b>Comments</b>
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"/> <b>Yes</b> <input type="checkbox"/> <b>No</b> <input type="checkbox"/> <b>Unclear</b>	

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

<b>Criteria:</b> Students will...	<b>Course Meets Criteria?</b>	<b>Comments</b>
a) Interpret models and solve quantitative problems from different contexts with real world relevance.	<input type="checkbox"/> <b>Yes</b> <input type="checkbox"/> <b>No</b> <input type="checkbox"/> <b>Unclear</b>	
b) Create reasonable arguments supported by quantitative evidence (e.g., using words, tables, graphs, and/or mathematical equations).	<input type="checkbox"/> <b>Yes</b> <input type="checkbox"/> <b>No</b> <input type="checkbox"/> <b>Unclear</b>	
c) Communicate reasonable arguments supported by quantitative evidence (e.g., using words, tables, graphs, and/or mathematical equations).	<input type="checkbox"/> <b>Yes</b> <input type="checkbox"/> <b>No</b> <input type="checkbox"/> <b>Unclear</b>	
d) Demonstrate a variety of mathematical principles and methods of data analysis.	<input type="checkbox"/> <b>Yes</b> <input type="checkbox"/> <b>No</b> <input type="checkbox"/> <b>Unclear</b>	
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"/> <b>Yes</b> <input type="checkbox"/> <b>No</b> <input type="checkbox"/> <b>Unclear</b>	

**Total Number of QUANTITATIVE REASONING  
Criteria Met by Course Proposal:**

**/5**

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

**Total Number of SCIENTIFIC REASONING  
Criteria Met by Course Proposal:**

**/9**

<b>KNOWLEDGE OF THE PHYSICAL WORLD: COMPLETE AT LEAST THREE (INCLUDING THE FIRST TWO) OF THE FOLLOWING</b>		
<b>Criteria: Students will...</b>	<b>Course Meets Criteria?</b>	<b>Comments</b>
a) Describe some of the major concepts in science to explain natural phenomena.	<input type="checkbox"/> <b>Yes</b> <input type="checkbox"/> <b>No</b> <input type="checkbox"/> <b>Unclear</b>	
b) Evaluate the quality of scientific information on the basis of methods used to generate it.	<input type="checkbox"/> <b>Yes</b> <input type="checkbox"/> <b>No</b> <input type="checkbox"/> <b>Unclear</b>	
c) Use qualitative and/or quantitative analyses to draw inferences or conclusions from data.	<input type="checkbox"/> <b>Yes</b> <input type="checkbox"/> <b>No</b> <input type="checkbox"/> <b>Unclear</b>	
d) Explore complex questions and identify how they impact or are impacted by external issues (political, economic, or ethical).	<input type="checkbox"/> <b>Yes</b> <input type="checkbox"/> <b>No</b> <input type="checkbox"/> <b>Unclear</b>	

**Total Number of KNOWLEDGE OF THE PHYSICAL WORLD Criteria Met by Course Proposal:**

**/4**

**EVALUATION RUBRIC FOR GENERAL EDUCATION COURSE PROPOSALS**  
(to be completed by evaluator)

**Hands-On Science:**  
**experiential laboratory-based science**

Student Learning Outcomes

**Quantitative Reasoning:** Students will be able to interpret models and solve quantitative problems from different contexts with real world relevance; understand and create reasonable arguments supported by quantitative evidence; and clearly communicate those arguments in effective formats (e.g., using words, tables, graphs, and mathematical equations).

**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.

**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.

**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.

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

**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.

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

<b>5</b> Assessments far exceed the minimum requirements for ensuring student learning outcomes.	<b>4</b> Assessments exceed the minimum requirements for ensuring student learning outcomes.	<b>3</b> Assessments meet the minimum requirements for ensuring student learning outcomes.	<b>2</b> Assessments do not meet the minimum requirements for ensuring student learning outcomes.	<b>1</b> Assessments need significant improvement to ensure student learning outcomes.
---	---	---	--	---