ILO 7: Scientific Reasoning

Definition: Scientific reasoning includes problem identification, hypothesis evaluation, experimentation, interpretation of results, and the use and misuse of scientific data. Students are also introduced to the evolution and interdependence of science and technology.

Outcome: Students will

- formulate hypotheses, perform experiments, and analyze the results using appropriate technology to reach a logical conclusion.

Guidelines for General Education Assessment

1. This rubric should be used for **assessment.** It is not meant to be used for grading.
2. You will be asked to report your assessment data in the **Level 1-4** format. Any other reporting format (0-100, for example) will create an inconsistency in scoring and render the data invalid.
3. When using this rubric, it is **not** always expected that all categories on the rubric are assessed in a single assignment. Only report on the categories actually assessed.
4. Set expectations **before** you give an assignment. The expectations for how many students achieve at each level will depend on the level of the course. For example, 100-level courses may rarely have students in the Level 4 category, while higher-level courses will likely have more students achieving Level 4.
5. Ideally, General Education courses that have more than one section should use the same signature assignments and rubrics to assess an ILO in all the sections.
6. Collect data from as many sections as possible. For courses that have multiple sections, it is ideal to have a departmental assessment coordinator. The coordinator can then collate all assessment data.
7. It is the responsibility of the chair of the department (who may delegate to the assessment coordinator) to ensure that all adjuncts who teach General Education courses use agreed- upon signature assignments and collect assessment data.
8. For courses that offer multiple sections, submit data from as many sections as possible. However, if data is missing from one or two sections, simply state this in the narrative and give information for only the sections for which data exists.
9. Remember to collect artifacts (completed student assignments) for each level represented in your course. Artifacts should NOT have any student identifying information (remove names).

This rubric was adapted from the Association of American Colleges and Universities (AAC&U) Inquiry and Analysis VALUE Rubrics. Retrieved from https://www.aacu.org/value-rubrics

SCIENTIFIC REASOING RUBRIC

	Level 4	Level 3	Level 2	Level 1
Question, Argument or Topic selection: Develops, distinguishes or identifies a manageable and appropriate question that is tied to testable hypotheses	Identifies a creative, focused and manageable topic. States a testable hypothesis or research question capable of generating new or replicating existing knowledge in a given field.	Identifies a manageable topic suitable for the purposes of scientific inquiry. States a testable hypothesis or research question logically connected to identified topic or problem.	Identifies a topic that is too narrowly manageable for the purposes of scientific inquiry; or hypothesis and argument are only partially testable or logically connected to identified topic or problem.	Identifies a topic that is unmanageable for the purposes of scientific inquiry; or hypothesis and argument are not testable or not logically connected to identified topic or problem.
Existing Knowledge, Research, and/or Views: Distinguishing a scientific argument from a non-scientific argument	Synthesizes in-depth information from credible and relevant sources representing various points of view/approaches.	Presents in-depth information from credible and relevant sources representing various points of view/approaches.	Presents information from credible and relevant sources representing limited points of view/approaches.	Presents information from non-credible and irrelevant sources representing limited points of view/approaches.
Methodology/Data Collection Selects and/or develops appropriate scientific methodologies	All elements of the methodology or theoretical framework are skillfully developed. Appropriate methodology or theoretical frameworks may be synthesized from across disciplines or from relevant subdisciplines. Methodology results in the collection of reliable and relevant data with exceptional precision or novel approaches.	Critical elements of the methodology or theoretical framework are appropriately developed, however, more subtle elements are ignored or unaccounted for. Methodology results in the collection of reliable and relevant data.	Critical elements of the methodology or theoretical framework are missing, incorrectly developed or unfocused. Methodology results in the collection of limited reliable and relevant data.	Inquiry demonstrates a misunderstanding of the methodology or theoretical framework. Methodology results in the collection of unreliable or irrelevant data.
Analysis, Results and Presentation Reasoning by deduction, induction, and analogy. Analyzes and presents appropriately collected data	Organizes and synthesizes evidence to reveal insightful patterns, differences, or similarities related to focus. Demonstrates elegant ability to reason by deduction, induction, and analogy. Evaluation and presentation of data reveals insightful patterns, differences and similarities related to hypotheses and research questions including an explanation of error.	Organizes evidence to reveal important patterns, differences, or similarities related to focus. Demonstrates appropriate ability to reason by deduction, induction, and analogy. Evaluation and presentation of data is adequate and connects to the hypotheses and research questions; Evidence reveals some patterns, differences or similarities.	Organizes evidence, but the organization is not effective in revealing important patterns, differences, or similarities. Demonstrates limited ability to reason by deduction, induction, and analogy. Evaluation and presentation of data is partially adequate and connects to the hypotheses and argument; Evidence reveals little patterns, differences or similarities.	Lists evidence, but it is not organized and/or is unrelated to focus. Demonstrates no ability to reason by deduction, induction, and analogy. Data is presented, but does not reveal clear patterns, differences or similarities.
Discussion/Conclusions, Limitations and Implications: Distinguishing between causal and correlational relationships. Links conclusions to evidence in the form of limitations and implications	States a conclusion that is a logical extrapolation from the inquiry findings limitations and implications. Demonstrates advanced ability to distinguish between causal and correlational relationships.	States a conclusion focused solely on the inquiry findings. The conclusion arises specifically from and responds specifically to the inquiry findings limitations and implications. Demonstrates appropriate ability to distinguish between causal and correlational relationships.	States a general conclusion that, because it is so general, also applies beyond the scope of the inquiry findings limitations and implications. Demonstrates limited ability to distinguish between causal and correlational relationships.	States an ambiguous, illogical, or unsupportable conclusion from inquiry findings limitations and implications. Demonstrates no ability to distinguish between causal and correlational relationships