**Major Assessment Report Template**

Please download this document and provide a response to each question in the appropriate section. Send your assessment reports to the Director of Assessment, Dr. Melissa Jordine (mjordine@csufresno.edu). (Reports can be sent to Dr. Jordine via campus mail to mailstop SS 21). Please complete a separate report for each B.A/B.S. and M.A/M.S. program offered by the department.

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| 1. **What learning outcome(s) did you assess this year?** List all program outcomes you assessed (if you assessed an outcome not listed on your department SOAP please indicate explain). Do not describe the measures or benchmarks in this section Also please only describe major assessment activities in this report. No GE assessment was required for the 2016-2017 academic year.

SLO: A in Goal 1 (“Synthesize knowledge and skills in the basic components of the Sciences, and develop a familiarity with the scientific methodology.”) SLO: B in Goal 2 (“Students will demonstrate scientific literacy by applying their scientific knowledge and critical thinking skills to evaluate and interpret scientific claims.”). |
| 1. **What assignment or survey did you use to assess the outcomes and what method (criteria or rubric) did you use to evaluate the assignment?** If the assignment (activity, survey, etc.) does not correspond to the activities indicated in the timeline on the SOAP, please indicate why. Please clearly indicate how the assignment/survey is able to measure a specific outcome. If after evaluating the assessment you concluded that the measure was not clearly aligned or did not adequately measure the outcome please discuss this in your report. Please include the benchmark or standard for student performance in your assessment report (if it is stated in your SOAP then this information can just be copied into the report). An example of an expectation or standard would be “On outcome 2.3 we expected at least 80% of students to achieve a score of 3 or above on the rubric.”

The NSCI106 course had a student population of seven in Spring 2017. Only **4** of those students were Natural Science majors; one Chemistry, one Philosophy, one Biology major. This data only represents the four Natural Science majors .**Science Literacy Concept Inventory**The Science Literacy Concept Inventory (Nuhfer, 2011) was administered on the first day of the class, to assess the fundamental level of science literacy in twelve concepts.Results are presented as relative averages for each concept in table 1.Table 1. Science Literacy Concept Inventory results.

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| --- | --- |
| **Science Literacy Concept** | **Relative Average Correct (all students)** |
| 1. Define the domain of science and determine whether a statement constitutes a hypothesis that can be resolved within that domain. | 91.7% |
| **2. Describe through example how science literacy is important in everyday life to an educated person.** | **68.8%** |
| 3. Explain why the attribute of doubt has value in science. | 87.5% |
| 4. Explain how scientists select which among several competing working hypotheses best explains a physical phenomenon. | 75.0% |
| 5. Explain how "theory" as used and understood in science differs from "theory "as commonly used and understood by the general public. | 93.8% |
| **6. Explain why peer review generally improves our quality of knowing within science.** | **62.5%** |
| **7. Explain how science employs the method of reproducible experiments to understand and explain the physical world.** | **68.8%** |
| 8. Articulate how science’s way of knowing rests on some assumptions. | 81.3% |
| **9. Distinguish between science and technology by examples of how these are different frameworks of reasoning.** | **37.5%** |
| 10. Cite a single major theory from one of the science disciplines and explain its historical development. | 75.0% |
| 11. Explain and provide an example of how modeling is used in science. | 81.3% |
| 12. Explain why ethical decision-making becomes increasingly important to a society as it becomes increasingly advanced in science. | 100.0% |
| **Overall score** | **75.5%** |

**Science Process Skills Lesson Plan**A major assignment in the course was the preparation of an inquiry-oriented science learning activity using the 5E learning cycle format (Bybee, et al; 2002). Lessons were to focus on Disciplinary Core Ideas, Science and Engineering Practices, and Crosscutting Concepts from the *Next Generation Science Standards* (NGSS Lead States, 2013). Additionally, students identified salient *Science Process Skills* (Roth & Roychoudhury, 1993) and connections to the *Nature of Science* (Schweingruber, Keller, & Quinn; 2011). Prior to the assignment, students identified the key ideas and constructs to be evaluated in the assignment, organized into a grading checklist. The assignment entailed the presentation of a science process skills activity and written 5E lesson plan (Appendix 1). Student achievement for this assignment is summarized in Table 2.Table 2. Science Process Skills lesson plan performance.

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| --- | --- | --- | --- | --- |
| **Student** | **Inquiry Presentation** | **Lesson Plan****5E** | **Lesson Plan****SPS** | **Lesson Plan NOS** |
| A | YES | YES | YES | YES |
| B | YES | YES | YES | YES |
| C | YES | YES | YES | YES |
| D | YES | YES | YES | YES |

**Views of the Nature of Science Survey**The third major assessment activity in the course was a pre and post administration of the Views of the Nature of Science Survey (Lederman, et al; 2002). The instrument (Appendix 2) addresses these fundamental aspects of NOS:* The empirical nature of scientific knowledge
* Scientific theories and laws
* The theory-laden nature of scientific knowledge
* The social and cultural embeddedness of scientific knowledge
* The myth of a singular scientific method
* The tentative nature of scientific knowledge

Students’ open-ended responses to survey items were analyzed for a naive or informed view of these constructs.Table 3. VNOS results.

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| --- | --- | --- |
| **Student** | **Pre-survey overall**  | **Post-survey overall** |
| A | NAIVE | INFORMED |
| B | NAIVE | INFORMED |
| C | NAIVE | INFORMED |
| D | INFORMED | INFORMED |

 No indirect measures were included in the 2016-2017 assessment due in part to a very small Nof 4. Next year, Natural Science Degree exit interviews will be completed for graduates from 2017 and 2018 when there is a larger and statistically meaningful N. |
| 1. **What did you discover from the data?** Discuss the student performance in relation to your standards or expectations. Be sure to clearly indicate how many students did (or did not) meet the standard for each outcome measured. Where possible, indicate the relative strengths and weaknesses in student performance on the outcome(s).

In general, students demonstrated an appropriate level of science literacy on most concepts, with an overall score of 75.5% on all items. The exceptions are concepts 2, 6, 7, & 9. Scores on concepts 6 and 9 were similarly low for students in 2016. The feature of the assignment with which some students had difficulty was the explicit identification of science process skills, suggesting a need for emphasis in future classes and possibly in other courses in the major. Some consideration should also be given to infusing explicit learning experiences relevant to these concepts into coursework. Outcome A& B have been met.Results demonstrate that all Natural Science students in the course were able to effectively apply the key aspects of SPS and NOS in the construction and presentation of a 5E inquiry-oriented lesson plan. Analysis of VNOS responses indicates that most students (80%) developed more informed ideas overall about various components of NOS, particularly empirical and tentative nature of scientific knowledge and the differences between theory and law. The myth of a singular scientific method was an area that indicated less growth for some students, indicating a need for more emphasis in future classes. REFERENCESBybee, R. W., Taylor, J. A., Gardner, A., Van Scotter, P., Carlson Powell, J., Westbrook, A., & Landes, N. (2002). The BSCS 5E instructional model.*Origins, effectiveness and applications*.Lederman, N. G., Abd‐El‐Khalick, F., Bell, R. L., & Schwartz, R. S. (2002). Views of nature of science questionnaire: Toward valid and meaningful assessment of learners' conceptions of nature of science. *Journal of research in science teaching*, *39*(6), 497-521.NGSS Lead States. (2013). *Next generation science standards: For states, by states*. National Academies Press.Nuhfer, E. (2011, October). First results from the science literacy concept inventory: The reasoning we don’t produce through gen-ed. In *2011 GSA Annual Meeting in Minneapolis*.Roth, W. M., & Roychoudhury, A. (1993). The development of science process skills in authentic contexts. *Journal of Research in Science Teaching*, *30*(2), 127-152.Schweingruber, H., Keller, T., & Quinn, H. (Eds.). (2012). *A Framework for K-12 Science Education:: Practices, Crosscutting Concepts, and Core Ideas*. National Academies Press. |
| 1. **What changes did you make as a result of the data?** Describe how the information from the assessment activity was reviewed and what action was taken based on the analysis of the assessment data.

Based upon this year’s result, some consideration will be given to infusing more explicit learning experiences relevant to scientific literacy concepts into coursework. |
| 1. **What assessment activities will you be conducting in the 2017-2018 AY?** List the outcomes and measures or assessment activities you will use to evaluate them. These activities should be the same as those indicated on your current SOAP timeline; if they are not please explain.

For the 2017-2018 academic year, the Natural Science SOAP requires the assessment of Outcome A in Goal 1 (“Synthesize knowledge and skills in the basic components of the Sciences, and develop a familiarity with the scientific methodology.”) and Outcome B in Goal 2 (“Students will demonstrate scientific literacy by applying their scientific knowledge and critical thinking skills to evaluate and interpret scientific claims.”). Outcome C examines how well students effectively disseminate an understanding of scientific material and conclusions by means of written reports.1. **Instruments used to assess the learning outcomes**

 a. Direct Measures b.Indirect measure (alumni surveys).For the 2017-2018 academic year, the Natural Science SOAP requires surveys to Natural Science Degree alumni. The surveys of Natural Science degree graduates are indirect, self-reporting measures of student’s perceived valuing of the degree program and what they learned as students. This alumni survey can help the program potentially to make changes as necessary based upon student feedback. Surveys will be administered in 2017-2018 to alumni of the Natural Science Degree program. |
| 1. **What progress have you made on items from your last program review action plan?** Please provide a brief description of progress made on each item listed in the action plan. If no progress has been made on an action item, simply state “no progress.”

We just completed our Program Review in May and no action plan has yet been developed as of this reporting period.**Additional Guidelines:** If you have not fully described the assignment then please attach a copy of the questions or assignment guidelines. If you are using a rubric and did not fully describe this rubric (or the criteria being used) than please attach a copy of the rubric. If you administered a survey please consider attaching a copy of the survey so that the Learning Assessment Team (LAT) can review the questions.APPENDIX 1Science Process Skills Presentation & Lesson Plan Names \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Rubric \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_LESSON PLAN Appropriate? COMMENTSEngage Yes NoExplore Yes NoExplain Yes NoExtend Yes NoEvaluate Yes NoIdentified Science Process Skill(s)  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Yes No \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Yes No \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Yes NoNature of Science connections \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Yes No \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Yes No \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Yes NoAligned to NGSS SEPs Yes No CCCs Yes No DCIs Yes NoPRESENTATION COMMENTS Efficiency Yes No Time Management Yes No Articulate Yes No Answers to follow-up ?s Yes NoOrganization Introduction Yes No  Body Yes No Conclusion Yes NoAPPENDIX 21. What, in your view, is science? What makes science (or a scientific discipline such as physics, biology, etc.) different from other disciplines of inquiry (e.g., religion, philosophy)?1. What is an experiment?
2. Does the development of scientific knowledge require experiments?
	1. If yes, explain why. Give an example to defend your position.
	2. If no, explain why. Give an example to defend your position.
3. After scientists have developed a scientific theory (e.g., atomic theory, evolution theory), does the theory ever change?
	1. If you believe that scientific theories do not change, explain why. Defend your answer with examples.
	2. If you believe that scientific theories do change: (a) Explain why theories change; (b) Explain why we bother to learn scientific theories. Defend your answer with examples.
4. Is there a difference between a scientific theory and a scientific law? Illustrate your answer with an example.
5. Science textbooks often represent the atom as a central nucleus composed of protons (positively charged particles) and neutrons (neutral particles) with electrons (negatively charged particles) orbiting the nucleus. How certain are scientists about the structure of the atom? What specific evidence do you think scientists used to determine what an atom looks like?
6. Science textbooks often define a species as a group of organisms that share similar characteristics and can interbreed with one another to produce fertile offspring. How certain are scientists about their characterization of what a species is? What specific evidence do you think scientists used to determine what a species is?
7. It is believed that about 65 million years ago the dinosaurs became extinct. Of the hypothesis formulated by scientists to explain the extinction, two enjoy wide support. The first, formulated by one group of scientists, suggests that a huge meteorite hit the earth 65 million years ago and led to a series of events that caused the extinction. The second hypothesis, formulated by another group of scientists, suggests that massive and violent volcanic eruptions were responsible for the extinction. How are these different conclusions possible if scientists in both groups have access to and use the same set of data to derive their conclusions?
8. Some claim that science is infused with social and cultural values. That is, science reflects the social and political values, philosophical assumptions, and intellectual norms of the culture in which it is practiced. Others claim that science is universal. That is, science transcends national and cultural boundaries and is not affected by social, political, and philosophical values, and intellectual norms of the culture in which it is practiced.
	1. If you believe that science reflects social and cultural values, explain why. Defend your answer with examples.
	2. If you believe that science is universal, explain why. Defend your answer with examples.
9. Scientists perform experiments/investigations when trying to find answers to the questions they put forth. Do scientists use their creativity and imagination during their investigations?
	1. If yes, then at which stages of the investigations do you believe scientists use their imagination and creativity: planning and design, data collection, after data collection? Please explain why scientists use imagination and creativity. Provide examples if appropriate.
	2. If you believe that scientists do not use imagination and creativity, please explain why. Provide examples if appropriate.
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