APPLY SCIENTIFIC INQUIRY AND SCIENTIFIC HABITS OF MIND

Performance Standard 11A/13A/13 B.H

Students will apply the concepts, principles and processes of scientific inquiry within classroom investigations accordingly:

- *Knowledge*: Understand the concepts, principles and processes of scientific inquiry.
- *Application*: Apply the appropriate scientific habits of mind when investigating science concepts.
- *Communication*: Incorporate scientific technologies and the processes of scientific inquiry into classroom investigations and reports.
- **Note to teacher: These concepts could be embedded into scientific issue investigations. Suggested activities for standards 12A, B, C, E, and F at stage H, incorporate many of the performance descriptions for Standard 11A, 13A and 13B.**

Procedures

1. ***In order to know and apply the concepts, principles and processes of scientific inquiry (11A) and the accepted practices of science (13A) and apply scientific technologies (13B),*** students should experience sufficient learning experiences to develop the following:
   - Formulate an issue-specific hypothesis, such as:
     - Interaction of resource acquisition, technological development and ecosystem impact.
     - Natural resource conservation and management programs.
     - Policies which affect local science or technology issues.
   - Generate inquiry questions for the premise of the investigation.
   - Differentiate qualitative and quantitative data and their appropriate usefulness in the investigation.
   - Use appropriate models (conceptual, mathematical or physical, etc.) for foundation of investigation.
   - Preview pertinent sources of scientific research related to historic and current foundations for similar studies as primary reading sources.
   - Evaluating evidence and sources of information from resource information.
   - Collect pertinent data from expert sources.
   - Design and conduct inquiry investigation which finds answers to posed hypotheses/questions.
   - Propose applicable survey instruments to assess depths of informed opinions on issues.
   - Select associated research, analysis and communication components.
   - Choose applicable mathematical processes and calculations.
   - Project possible viewpoints, variables, data sets and formats for consideration.
   - Conduct teacher-approved issue investigation.
   - Use scientific technologies to collect, store, retrieve, assimilate and communicate data, as applicable.
   - Incorporate appropriate safety precautions and materials and equipment handling directions to minimize safety hazards, as applicable.
   - Recognize the necessity of controlled variables, carefully and accurately recorded objective observations and replicable multiple trials.
   - Follow established formats for random sampling.
   - Prepare data tables, charts and visualizations.
   - Document applicable observational and graphic data (using appropriate labels and metric units) accurately with appropriate precision.
   - Reviewing experimental procedures or explanations for possible faulty reasoning or unproven statements.
   - Interpret and represent analysis of results.
   - Project trends within data sets.
   - Evaluate data sets to explore explanations of unexpected responses and data concurrence.
   - Evaluate survey validity and reliability.
   - Analyze research and data which may support or refute hypothesis.
   - Differentiate inferences, deductions and perceptions.
   - Explain why similar investigations should but may not produce similar results or conclusions.

- Report, display and defend the process and findings in oral and written format for peer review within and/or beyond the classroom.
- Present final report for action response actions.
- Critiquing findings from investigations (self and peers).
- Generate further questions or issues for consideration.
- Reflect on procedural refinements.
- Evaluate comparable issue resolutions or responses for action for applicable correlations, consolidation or explanations.
- Identify how scientific habits of mind (scientific reasoning, insight, skill, creativity, intellectual honesty, tolerance of ambiguity, skepticism, persistence and openness to new ideas) are integral in the investigation.

2. Separated assessment of 11A or 13A may not be practical. Significant research has demonstrated the value of inquiry-based life-long learning for students. The emphasis of scientific inquiry is incorporated into the wording of all performance descriptions for Goal 12, in stages A-J. A spiraling inquiry-based curriculum is encouraged for all classrooms at all stages. Specific performance descriptions may be emphasized in different issue investigations in order to build mastery of each concept or process of scientific inquiry.
3. See suggested procedures for 12A, 12B, 12 C, 12E and 12F at stage H for specific assessment features.

Examples of Student Work not available

Time Requirements

- Initial introduction of processes may require additional time as needed by students.