APPLY TECHNOLOGICAL DESIGN AND SCIENTIFIC HABITS OF MIND

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

Students will apply the concepts, principles and processes of technological design within classroom investigations accordingly:

- *Knowledge*: Understand the concepts, principles and processes of technological design,
- *Application*: Apply the appropriate scientific habits of mind when investigating science concepts, and
- *Communication*: Incorporate the scientific technologies and processes of technological design into classroom investigations and reports.

Note to teacher: These concepts could be embedded into technological design investigations. Suggested activities for standards 12C and D at stage H, incorporate many of the performance descriptions for Standard 11B, 13A and 13B.

Procedures

1. ***In order to know and apply the concepts, principles and processes of technological design (11A) and the accepted practices of science (13A) and the concepts that describe the interaction between science, technology and society (13B),*** students should experience sufficient learning experiences to develop the following:
   - Generate strategies for possible technological designs in terms of testing the scientific concept.
   - Brainstorm pertinent applicable design variables.
   - Research and evaluate sources of scientific information related to the science principle.
   - Question sources of information.
   - Suggest appropriate materials, equipment and data-collection strategies, procedural sequence, success criteria and design options to safely test the technological design.
   - Include peer review for choice of design and criteria selection.
   - Create process for testing design.
   - Explain necessity of varying of only one variable at a time.
   - Sketch schematic of design test.
   - Incorporate appropriate safety precautions, available technology and equipment capabilities into construction and testing of design.
   - Follow classroom rules for preparation, procedures and clean-up.
   - Test prototype of design by conducting multiple trials and record observations.
   - Use consistent metric measuring and recording techniques with necessary precision.
   - Retrieve data from collecting instruments accurately and honestly in selected format.
   - Graph data appropriately according to tested variables.
   - Represent results of analysis to produce findings.
   - Compare data sets of the prototype to how they meet the success criteria.
   - Evaluate multiple prototype solutions to the overall design success.
   - Interpret trends within data.
   - Inferring statements based on data.
   - Propose explanations for sources of error in the data set with regards to product design flaws.
   - Review experimental procedures or explanations for possible faulty reasoning or unproven statements.
   - Report the process and results of investigation in oral and/or written presentations using available technologies.
   - Select graphs and charts that effectively report the design data.
   - Propose logical explanations of success and/or errors.
   - Generate alternative design modifications for future investigations.
   - Apply scientific habits of mind in investigation process and analysis.
   - Distinguishing relationships of scientific theories, models, hypotheses, experiments and methodologies.

2. Separated assessment of 11B may not be practical. Significant research has demonstrated the value of inquiry-based hands-on life-long learning for students. The emphasis of technological design 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. Specific performance descriptions may be emphasized in different technological design investigations in order to build mastery of each concept or process of technological design.
3. See suggested procedures for 12C and 12D 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.