

APPLY TECHNOLOGICAL DESIGN AND SCIENTIFIC HABITS OF MIND

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

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.
- *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 12D and E at stage J, 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:

- Formulate proposals for innovative technological design solution.
- Generate ideas for possible technological innovations and variables.
- Identify design constraints due to access to tools, materials and time.
- Consider how scientists address validity of scientific claims and theories.
- Research applicable scientific principles or concepts in primary sources of literature.
- Question sources of information and representation of data.
- Trace citations from research studies for validity and reliability.
- Design and conduct the technological innovation testing.
- Recognize limitations of investigation methods, sample sets, technologies or procedures.
- Develop the sequence of the design with visualizations.
- Incorporate appropriate safety, available technology and equipment capabilities into construction of design.
- Repeat procedural steps for sufficient statistical validity.
- Follow classroom rules for preparation, procedures and clean-up.
- Document data from instruments accurately in selected form.
- Use consistent metric measuring and recording techniques with necessary precision.
- Graph data appropriately to show relation to tested variables in design solution proposal.
- Interpret and represent results of analysis to produce findings.
- Compare data sets of the prototype to design criteria.
- Evaluate multiple criteria for suitability, acceptability and benefits.
- Inferring statements based on data.
- Propose explanations for sources of error in the data set for process or 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.
- Explain application to appropriate scientific principle or concept.
- Communicate anecdotal and quantitative observations.
- Select graphs and charts that effectively report the design data.
- Recognize selective or distorted use of data, discrepancies and poor argument.
- Recognize self-monitoring and correction methodologies in research studies.
- Analyze a logical explanation 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.

1. 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.
2. See suggested procedures for 12D and 12E at stage J for specific assessment features.

Examples of Student Work not available

Time Requirements

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