APPLY TECHNOLOGICAL DESIGN AND SCIENTIFIC HABITS OF MIND

Performance Standard 11B/13A/13B.I
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 historic technological design investigations. Suggested activities for standards 12 D, E, and F at stage I, incorporate many of the performance descriptions for Standard 11B in an historic context.

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 interactions between science technology and society (13B),*** students should experience sufficient learning experiences to develop the following:
   - Identify **an important historic engineering feat, innovation or model** of a technological design from curricular studies.
   - Brainstorming the kinds of barriers or circumstances that existed in the original setting.
   - Researching historic dilemmas which necessitated new scientific or engineering solutions.
   - Research pertinent contextual foundation related to the historical period.
   - Identify the simulation materials and procedural sequence or scale models which can simulate the historic conditions.
   - Determine the success criteria, design constraints and testing logistics that were encountered.
   - Sketch the progressive schematics of design stages and prototype.
   - Collect appropriate materials, supplies and safety equipment.
   - Complete the assembly of the model of the innovation, following all safety precautions and classroom rules for preparation, procedures and clean-up.
   - Select appropriate graphic display of data to show relation of tested success criteria variables.
   - Test prototype by conducting multiple trials according to success criteria, scale and design constraints.
   - Collect reliable and precise data from collecting instruments in selected format.
   - Record anecdotal observations.
   - Compare and summarize data from multiple trials.
   - Analyze available historic data from original investigations.
   - Analyze data from multiple trials from model investigation.
   - Correlate historic conditions to model testing.
   - Identify faulty procedural steps which could become sources of error or design flaws.
   - Select graphs and charts that most effectively report the design data,
   - Communicate an evaluation report (in oral and/or written format),
   - Relate the historical setting and impact to the scientific or engineering solutions and eventual progression of designs,
   - Generate design modifications which can be tested or could have been considered historically,
   - Identify the scientific habits of mind (scientific reasoning, insight, creativity, skill, intellectual honesty, tolerance of ambiguity, skepticism, persistence, openness to new ideas and sheer luck) that were integral to the discovery or innovation.
   - Evaluate public perceptions of the value of the scientific research at the time of the innovation.
2. Separated assessment of 11Bmay 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 12 D, E, and F at stage I for specific assessment features about historic innovations.

Examples of Student Work not available

Resources

Time Requirements

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