

Standard 5—Technology

Elementary

Engineering Design

1. Engineering design is an iterative process involving *modeling* and *optimization* used to develop technological solutions to problems within given constraints.

Students:

- describe objects, imaginary or real, that might be modeled or made differently and suggest ways in which the objects can be changed, fixed, or improved.
- investigate prior solutions and ideas from books, magazines, family, friends, neighbors, and community members.
- generate ideas for possible solutions, individually and through group activity; apply age-appropriate mathematics and science skills; evaluate the ideas and determine the best solution; and explain reasons for the choices.
- plan and build, under supervision, a model of the solution using familiar materials, processes, and hand tools.
- discuss how best to test the solution; perform the test under teacher supervision; record and portray results through numerical and graphic means; discuss orally why things worked or didn't work; and summarize results in writing, suggesting ways to make the solution better.

This is evident, for example, when students:

- ▲ read a story called *Humpty's Big Day* wherein the readers visit the place where Humpty Dumpty had his accident, and are asked to design and model a way to get to the top of the wall and down again safely.
- ▲ generate and draw ideas for a space station that includes a pleasant living and working environment.
- ▲ design and model footwear that they could use to walk on a cold, sandy surface.

Tools, Resources, and Technological Processes

2. Technological tools, materials, and other resources should be selected on the basis of safety, cost, availability, appropriateness, and environmental impact; technological processes change energy, information, and material resources into more useful forms.

Students:

- explore, use, and process a variety of materials and energy sources to design and construct things.
- understand the importance of safety, cost, ease of use, and availability in selecting tools and resources for a specific purpose.
- develop basic skill in the use of hand tools.
- use simple manufacturing processes (e.g., assembly, multiple stages of production, quality control) to produce a product.
- use appropriate graphic and electronic tools and techniques to process information.

This is evident, for example, when students:

- ▲ explore and use materials, joining them with the use of adhesives and mechanical fasteners to make a cardboard marionette with moving parts.
- ▲ explore materials and use forming processes to heat and bend plastic into a shape that can hold napkins.
- ▲ explore energy sources by making a simple motor that uses electrical energy to produce continuous mechanical motion.
- ▲ develop skill with a variety of hand tools and use them to make or fix things.
- ▲ process information electronically such as using a video system to advertise a product or service.
- ▲ process information graphically such as taking photos and developing and printing the pictures.

Key ideas are identified by numbers (1).
Performance indicators are identified by bullets (•).
Sample tasks are identified by triangles (▲).

Students will apply technological knowledge and skills to design, construct, use, and evaluate products and systems to satisfy human and environmental needs.

Computer Technology

3. Computers, as tools for design, modeling, information processing, communication, and system control, have greatly increased human productivity and knowledge.

Students:

- identify and describe the function of the major components of a computer system.
- use the computer as a tool for generating and drawing ideas.
- control computerized devices and systems through programming.
- model and simulate the design of a complex environment by giving direct commands.

This is evident, for example, when students:

- ▲ control the operation of a toy or household appliance by programming it to perform a task.
- ▲ execute a computer program, such as SimCity, Theme Park, or The Factory to model and simulate an environment.
- ▲ model and simulate a system using construction modeling software, such as The Incredible Machine.

Technological Systems

4. Technological systems are designed to achieve specific results and produce outputs, such as products, structures, services, energy, or other systems.

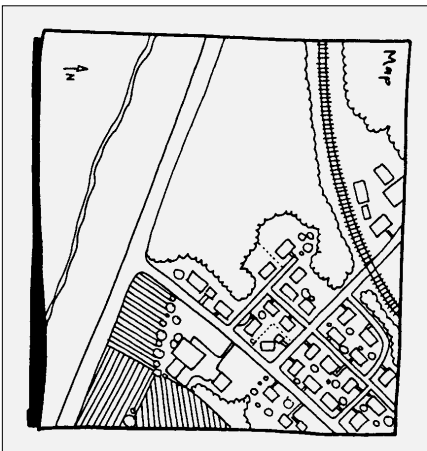
Students:

- identify familiar examples of technological systems that are used to satisfy human needs and wants, and select them on the basis of safety, cost, and function.
- assemble and operate simple technological systems, including those with interconnecting mechanisms to achieve different kinds of movement.
- understand that larger systems are made up of smaller component subsystems.

This is evident, for example, when students:

- ▲ assemble and operate a system made up from a battery, switch, and doorbell connected in a series circuit.
- ▲ assemble a system with interconnecting mechanisms, such as a jack-in-the-box that pops up from a box with a hinged lid.
- ▲ model a community-based transportation system which includes subsystems such as roadways, rails, vehicles, and traffic controls.

Sample Problem/Activity



Computer design for model community

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History and Evolution of Technology Impacts of Technology

5. Technology has been the driving force in the evolution of society from an agricultural to an industrial to an information base.

Students:

- **identify technological developments that have significantly accelerated human progress.**

This is evident, for example, when students:

- ▲ construct a model of an historical or future-oriented technological device or system and describe how it has contributed or might contribute to human progress.
- ▲ make a technological timeline in the form of a hanging mobile of technological devices.
- ▲ model a variety of timekeeping devices that reflect historical and modern methods of keeping time.
- ▲ make a display contrasting early devices or tools with their modern counterparts.

6. Technology can have positive and negative impacts on individuals, society, and the environment and humans have the capability and responsibility to constrain or promote technological development.

Students:

- **describe how technology can have positive and negative effects on the environment and on the way people live and work.**

This is evident, for example, when students:

- ▲ **handmake an item and then participate in a line production experience where a quantity of the item is mass produced; compare the benefits and disadvantages of mass production and craft production.**
- ▲ **describe through example, how familiar technologies (including computers) can have positive and negative impacts on the environment and on the way people live and work.**
- ▲ **identify the pros and cons of several possible packaging materials for a student-made product.**

Sample Problem/Activity

CAN WE REDUCE SOLID WASTE BY REDUCING PACKAGING?



...LS DEVELOPMENT

- **measuring** : Students are able to measure the amount of packaging waste generated in their homes during a given period of time.
- **graphing** : Students are able to graph their data and meaningfully combine it with others' data to form a class set.

Key ideas are identified by numbers (1).
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Sample tasks are identified by triangles (▲).

Students will apply technological knowledge and skills to design, construct, use, and evaluate products and systems to satisfy human and environmental needs.

Management of Technology

7. Project management is essential to ensuring that technological endeavors are profitable and that products and systems are of high quality and built safely, on schedule, and within budget.

Students:

- **participate in small group projects and in structured group tasks requiring planning, financing, production, quality control, and follow-up.**
- **speculate on and model possible technological solutions that can improve the safety and quality of the school or community environment.**

This is evident, for example, when students:

- ▲ help a group to plan and implement a school project or activity, such as a school picnic or a fund-raising event.
- ▲ plan as a group, division of tasks and construction steps needed to build a simple model of a structure or vehicle.
- ▲ redesign the work area in their classroom with an eye toward improving safety.

Sample Problem/Activity

HOW CAN WE REDUCE SOLID WASTE IN OUR SCHOOL?

Evaluation

Students will be able to develop and implement useful solid waste reduction strategies within their school based upon their investigations of the current solid waste stream.

