STANDARDS FOR TECHNOLOGICAL LITERACY:

Content for the Study of Technology

Executive Summary

The International Technology Education Association and its Technology for All Americans Project developed *Standards for Technological Literacy: Content for the Study of Technology* through funding from the National Science Foundation under Grant No. ESI-9626809 and the National Aeronautics and Space Administration under Grant No. NCC5-172. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation or the National Aeronautics and Space Administration.

Copies of this executive summary and *Standards for Technological Literacy: Content for the Study of Technology* may be purchased from the
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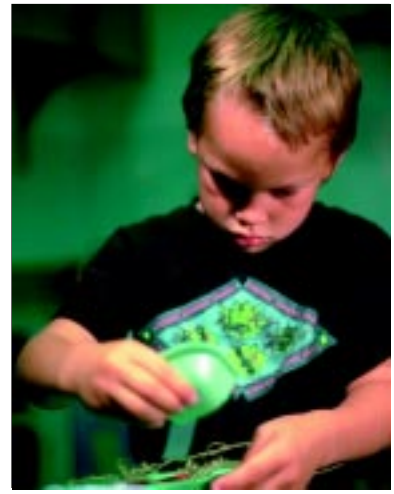
What is *Technology Content Standards*?

Standards for Technological Literacy: Content for the Study of Technology (***Technology Content Standards***) was published by the International Technology Education Association (ITEA) and its Technology for All Americans Project (TfAAP) in April 2000. It defines what students should know and be able to do in order to be technologically literate and provides standards that prescribe what the outcomes of the study of technology in grades K-12 should be. However, it does not put forth a curriculum to achieve these outcomes. ***Technology Content Standards*** will help ensure that all students receive an effective education about technology by setting forth a consistent content for the study of technology.



Why is *Technology Content Standards* important?

- Technological literacy enables people to develop knowledge and abilities about human innovation in action.
- ***Technology Content Standards*** establishes the requirements for technological literacy for all students — kindergarten through grade 12.
- ***Technology Content Standards*** provides qualitative expectations of excellence for all students.
- Effective democracy depends on all citizens participating in the decision-making process. Because so many decisions involve technological issues, all citizens need to be technologically literate.
- A technologically literate population can help our nation maintain and sustain economic progress.

Who developed *Technology Content Standards*?

Teams, committees, and various groups of educators, engineers, technologists, and others appointed by ITEA developed *Technology Content Standards*. This process exceeded three years, and six drafts were reviewed by educational professionals via mail, the Internet, and hearings at workshops around the country. Additionally, the document was submitted for field review to more than 60 schools nationwide. Over 4,000 people were involved in this review process. The National Research Council and the National Academy of Engineering also were actively involved in reviewing *Technology Content Standards*. After an extensive review process, they provided feedback that gave extended credibility to *Technology Content Standards*.

The Vision of *Technology Content Standards*

All students can become technologically literate.

Guiding Principles Behind *Technology Content Standards*

The standards and benchmarks were created with the following guiding principles:

- They offer a common set of expectations for what students should learn in the study of technology.
- They are developmentally appropriate for students.
- They provide a basis for developing meaningful, relevant, and articulated curricula at the local, state, and provincial levels.
- They promote content connections with other fields of study in grades K-12.
- They encourage active and experiential learning.

Who is a technologically literate person?

A person that understands — with increasing sophistication — what technology is, how it is created, how it shapes society, and in turn is shaped by society is technologically literate. He or she can hear a story about technology on television or read it in the newspaper and evaluate its information intelligently, put that information in context, and form an opinion based on it. A technologically literate person is comfortable with and objective about the use of technology — neither scared of it nor infatuated with it.

Technological literacy is important to all students in order for them to understand why technology and its use is such an important force in our economy. Anyone can benefit by being familiar with it. Everyone from corporate executives to teachers to farmers to homemakers will be able to perform their jobs better if they are technologically literate. Technological literacy benefits students who will choose technological careers—future engineers, aspiring architects, and students from many other fields. They can have a head start on their future with an education in technology.

What should students know and be able to do?

Technology Content Standards presents the content (knowledge and abilities) needed by students in grades K-12 to become technologically literate.

What is included in *Technology Content Standards*?

There are 20 standards that specify what every student should know and be able to do in in order to be technologically literate. The benchmarks that follow each of the broadly stated standards at each grade level articulate the knowledge and abilities that will enable students to meet the respective standard. A brief summary of the content standards and benchmarks are presented in the Compendium of Major Topics for ***Technology Content Standards***.

Compendium of Major Topics for *Technology Content Standards*

Standards	Benchmark Topics Grades K-2	Benchmark Topics Grades 3-5	Benchmark Topics Grades 6-8	Benchmark Topics Grades 9-12
CHAPTER 3 NATURE OF TECHNOLOGY				
1 The Characteristics and Scope of Technology	• Natural world and human-made world • People and technology	• Things found in nature and in the human-made world • Tools, materials, and skills • Creative thinking	• Usefulness of technology • Development of technology • Human creativity and motivation • Product demand	• Nature of technology • Rate of technological diffusion • Goal-directed research • Commercialization of technology
2 The Core Concepts of Technology	• Systems • Resources • Processes	• Systems • Resources • Requirements • Processes	• Systems • Resources • Requirements • Trade-offs • Processes • Controls	• Systems • Resources • Requirements • Optimization and trade-offs • Processes • Controls
3 Relationships Among Technologies and the Connections Between Technology and Other Fields	• Connections between technology and other subjects	• Technologies integrated • Relationships between technology and other fields of study	• Interaction of systems • Interrelation of technological environments • Knowledge from other fields of study and technology	• Technology transfer • Innovation and invention • Knowledge protection and patents • Technological knowledge and advances of science and mathematics and vice versa
CHAPTER 4 TECHNOLOGY AND SOCIETY				
4 The Cultural, Social, Economic, and Political Effects of Technology	• Helpful or harmful	• Good and bad effects • Unintended consequences	• Attitudes toward development and use • Impacts and consequences • Ethical issues • Influences on economy, politics, and culture	• Rapid or gradual changes • Trade-offs and effects • Ethical implications • Cultural, social, economic, and political changes
5 The Effects of Technology on the Environment	• Reuse and/or recycling of materials	• Recycling and disposal of waste • Affects environment in good and bad ways	• Management of waste • Technologies repair damage • Environmental vs. economic concerns	• Conservation • Reduce resource use • Monitor environment • Alignment of natural and technological processes • Reduce negative consequences of technology • Decisions and trade-offs
6 The Role of Society in the Development and Use of Technology	• Needs and wants of individuals	• Changing needs and wants • Expansion or limitation of development	• Development driven by demands, values, and interests • Inventions and innovations • Social and cultural priorities • Acceptance and use of products and systems	• Different cultures and technologies • Development decisions • Factors affecting designs and demands of technologies
7 The Influence of Technology on History	• Ways people have lived and worked	• Tools for food, clothing, and protection	• Processes of inventions and innovations • Specialization of labor • Evolution of techniques, measurement, and resources • Technological and scientific knowledge	• Evolutionary development of technology • Dramatic changes in society • HIstory of technology • Early technological history • The Iron Age • The Middle Ages • The Renaissance • The Industrial Revolution • The Information Age
CHAPTER 5 DESIGN				

8	The Attributes of Design	• Everyone can design • Design is a creative process	• Definitions of design • Requirements of design	• Design leads to useful products and systems • There is no perfect design • Requirements	• The design process • Design problems are usually not clear • Designs need to be refined • Requirements
9	Engineering Design	• Engineering design process • Expressing design ideas to others	• Engineering design process • Creativity and considering all ideas • Models	• Iteration • Brainstorming • Modeling, testing, evaluating, and modifying	• Design principles • Influence of personal characteristics • Prototypes • Factors in engineering design
10	The Role of Troubleshooting, Research and Development, Invention, and Innovation, and Experimentation in Problem Solving	• Asking questions and making observations • All products need to be maintained	• Troubleshooting • Invention and innovation • Experimentation	• Troubleshooting • Invention and innovation • Experimentation	• Research and development • Researching technological problems • Not all problems are technological or can be solved • Multidisciplinary approach

CHAPTER 6 ABILITIES FOR A TECHNOLOGICAL WORLD

11	Apply Design Processes	• Solve problems through design • Build something • Investigate how things are made	• Collecting information • Visualize a solution • Test and evaluate solutions • Improve a design	• Apply design process • Identify criteria and constraints • Model a solution to a problem • Test and evaluate • Make a product or system	• Identify a design problem • Identify criteria and contraints • Refine the design • Evaluate the design • Develop a product or system using quality control • Reevaluate final solution(s)
12	Use and Maintain Technological Products and Systems	• Discover how things work • Use tools correctly and safely • Recognize and use everyday symbols	• Follow step-by-step instructions • Select and safely use tools • Use computers to access and organize information • Use common symbols	• Use information to see how things work • Safely use tools to diagnose, adjust, and repair • Use computers and calculators • Operate systems	• Document and communicate processes and procedures • Diagnose a malfunctioning system • Troubleshoot and maintain systems • Operate and maintain systems • Use computers to communicate
13	Assess the Impact of Products and Systems	• Collect information about everyday products • Determine the qualities of a product	• Use information to identify patterns • Assess the influence of technology • Examine trade-offs	• Design and use instruments to collect data • Use collected data to find trends • Indentify trends • Interpret and evaluate accuracy of information	• Collect information and judge its quality • Synthesize data to draw conclusions • Employ assessment techniques • Design forecasting techniques

CHAPTER 7 THE DESIGNED WORLD

14	Medical Technologies	• Vaccinations • Medicine • Products to take care of people and their belongings	• Vaccines and medicine • Development of devices to repair or replace certain parts of the body • Use of products and systems to inform	• Advances and innovations in medical technologies • Sanitation processes • Immunology • Awareness of genetic engineering	• Medical technologies for prevention and rehabilitation • Telemedicine • Genetic therapeutics • Biochemistry
15	Agricultural and Related Biotechnologies	• Technologies in agriculture • Tools and materials for use in ecosystems	• Artificial ecosystems • Agriculture wastes • Processes in agriculture	• Technological advances in agriculture • Specialized equipment and practices • Biotechnology and agriculture • Artificial ecosystems and management • Development of refrigeration, freezing, dehydration, preservation, and irradiation	• Agricultural products and systems • Biotechnology • Conservation • Engineering design and management of ecosystems
16	Energy and Power Technologies	• Energy comes in many forms • Energy should not be wasted	• Energy comes in different forms • Tools, machines, products, and systems use energy to do work	• Energy is the capacity to do work • Energy can be used to do work using many processes • Power is the rate at which energy is converted from one form to	• Law of Conservation of energy • Energy sources • Second Law of Thermodynamics • Renewable and non-renewable forms of energy

				another • Power systems • Efficiency and conservation	• Power systems are a source, a process, and a load
17	Information and Communication	• Information • Communication • Symbols	• Processing information • Many sources of information • Communication • Symbols	• Information and communication systems • Communication systems encode, transmit, and receive information • Factors influencing the design of a message • Language of technology	• Parts of information and communication systems • Information and communication systems • The purpose of information and communication technology • Communication systems and subsystems • Many ways of communicating • Communication through symbols
18	Transportation Technologies	• Transportation systems • Individuals and goods • Care of transportation products and systems	• Transportation system use • Transportation systems and subsystems	• Design and operation of transportation systems • Subsystems of transportation system • Governmental regulations • Transportation processes	• Relationship of transportation and other technologies • Intermodalism • Transportation services and methods • Positive and negative impacts of transportation systems • Transportation processes and efficiency
19	Manufacturing Technologies	• Manufacturing systems • Design of products	• Natural materials • Manufacturing processes • Consumption of goods • Chemical technologies	• Manufacturing systems • Manufacturing goods • Manufacturing processes • Chemical technologies • Materials use • Marketing products	• Servicing and obsolescence • Materials • Durable or non-durable goods • Manufacturing systems • Interchangeability of parts • Chemical technologies • Marketing products
20	Construction Technologies	• Different types of buildings • How parts of buildings fit	• Modern communities • Structures • Systems used	• Construction designs • Foundations • Purpose of structures • Building systems and subsystems	• Infrastructure • Construction processes and procedures • Requirements • Maintenance, alterations, and renovation • Prefabricated materials

Future Standards

Now that *Technology Content Standards* has been published, there is a need for developing further technology standards: assessment standards, program standards, and professional development standards (in-service and pre-service). Teachers and administrators are asked to look at their current assessment techniques, and they are encouraged to develop new curricula based on *Technology Content Standards.* Using this publication, they can incorporate up-to-date assessment strategies that determine how well students meet these standards.

TECHNOLOGY FOR ALL AMERICANS PROJECT
was formed by the International Technology Education Association to promote the study of technology and technological literacy for all of society.

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