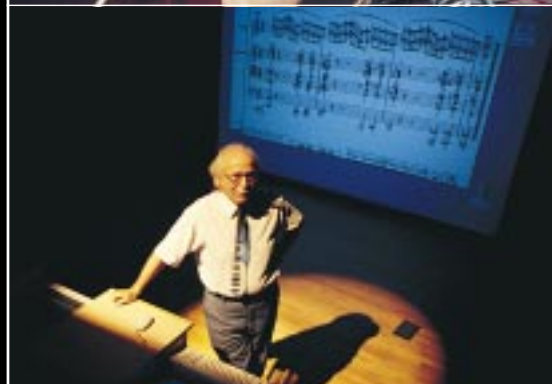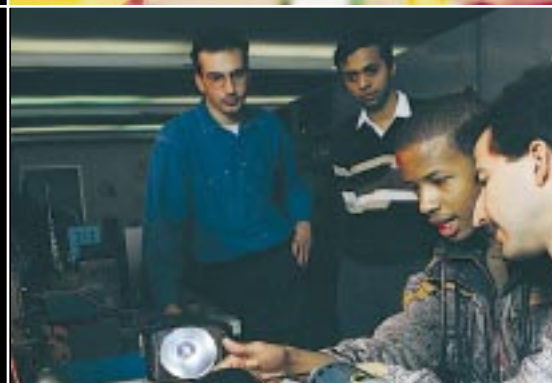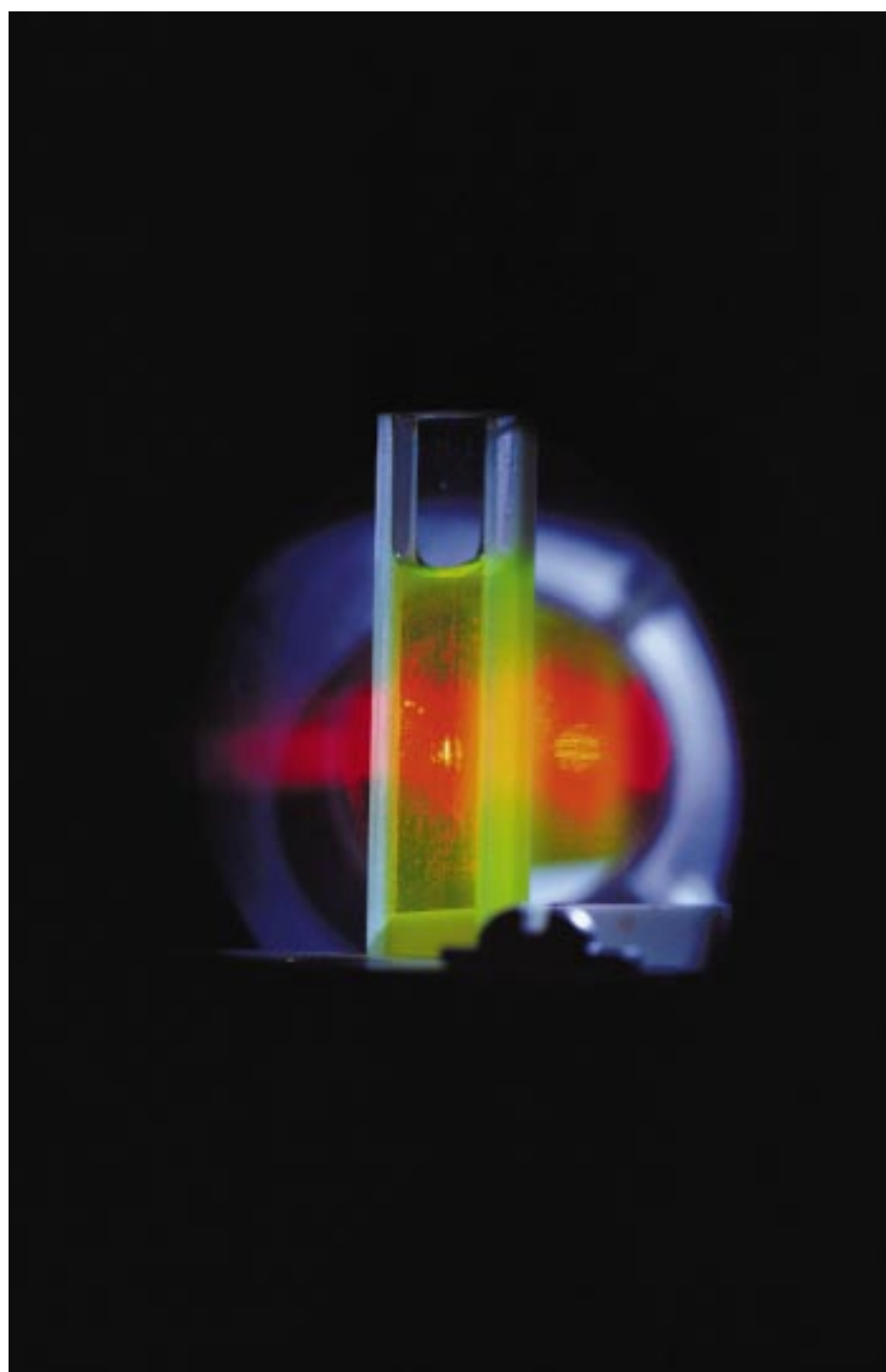# Technology for All Americans

A Rationale and Structure for the Study of Technology

*Technology is
human innovation
in action*

Technology for All Americans:

A Rationale and Structure for the Study of Technology

Contents

Preface

Technological literacy is much more than just knowledge about computers and their application.

This document is about education and a subject vital to human welfare and economic prosperity. It is about invigorating the entire educational system with high interest, student-focused content and methods. It is about developing a measure of technological literacy within each graduate so that every American can understand the nature of technology, appropriately use technological devices and processes, and participate in society's decisions on technological issues.

Technological literacy is much more than just knowledge about computers and their application. It involves a vision where each citizen has a degree of knowledge about the nature, behavior, power, and consequences of technology from a broad perspective. Inherently, it involves educational programs where learners become engaged in critical thinking as they design and develop products, systems, and environments to solve practical problems.

A Rationale and Structure for the Study of Technology is the first publication in a series envisioned to help educators improve and strengthen the preparation of each learner. Subsequent work will build upon this background and present technology education standards. The standards will provide a general framework from which schools can develop curricula and programs. This material will also provide the criteria for student assessment, teacher preparation, and enhancement and improvement of the learning environment.

The first part of this document discusses the power and the promise of technology and the need for technological literacy. The next section outlines the universal processes, knowledge, and contexts of technology. The third part describes how technology should be integrated into the core of the curriculum from kindergarten through secondary and post secondary education. The fourth and final section of this document challenges all concerned to establish technology education standards based on the universals outlined in this document, and to make technological literacy a national priority.

This document has been prepared by the Technology for All Americans Project through assistance from writing consultants. It has been reviewed by hundreds of practitioners of technology, science, mathematics, engineering, and other areas at all levels. Input has been gathered from a group of writing consultants, a National Commission for Technology Education, and educators across the country. Please read the document, study it, and join the International Technology Education Association in calling for and implementing the educational reform necessary to ensure technological literacy for all.

The Power and the Promise of Technology

Through technology, people have changed the world. In the drive to satisfy needs and wants, people have developed and improved ways to communicate, travel, build structures, make products, cure disease, and provide food. This has created a world of technological products and machines, roadways and buildings, and data and global communications. It has created a complex world of constant change.

Each technological advance builds on prior developments. Each advance leads to additional potentials, problems, and more advances in an accelerating spiral of development and complexity. The acceleration of technological change, and the greater potential and power that it brings, inspires and thrills some people, but confuses—even alienates—others. Many people embrace technological change, believing that through technology their lives will be made easier. They see the growing ability to solve age-old problems ranging from food supply to education and pollution. Others see a confusing interconnection of impersonal devices, and fear social, ecological, or military catastrophe. Some people find that through communication and transportation technology they can more easily maintain their personal relationships; others discover that the same technologies can strain relationships. Some believe that

through technological advances people create new jobs and new industries; others see automation replacing skilled labor and changing their way of life.

There is truth in all of these views, for technology is created, managed, and used by societies and individuals, according to their goals and values. For example, biotecnological developments can eradicate a plague or cause one. Industrial plants can be used to clean water or to pollute it. Nuclear energy can be used to provide power to heat millions of homes or to destroy millions of lives.

Technological systems have become so interrelated with one another and with today's social systems, that any new development can have far reaching effects. Recently people have seen that one development in microwave technology can alter the eating habits of millions; that an advance in radio telecommunications can create a multi-billion-dollar industry almost overnight; and that a common refrigerant can damage the Earth's protective atmosphere.

The promise of the future lies not in technology alone, but in people's ability to use, manage, and understand it.

Eighteenth century pioneers in the western wilderness of the Virginia and Pennsylvania colonies were able to provide themselves with everything they needed except for iron, lead, and salt. In today's urban society, people are more dependent upon others and upon technological processes and products.

People today inhabit a world of technological products and machines, roadways and buildings, data and global communications. Technology has become one of the major influences in the way people work, relax, interact, and meet their basic needs.

Courtesy of Bob Veltri

It is difficult to escape the effects of technological developments—even when pursuing "natural" activities, such as hiking. Shoes, clothes, and hygiene products are designed and made with computer–controlled machines. This hiker could be using a global positioning system, or possibly a compass, to identify her location.

The condition of the forest is influenced by human endeavors. Will hikers dispose of waste properly? Has the cutting of trees been managed with reforestation in mind? Have manufacturing and transportation systems polluted the air causing acid rain and destroying forests? Have the products carried into the forest been designed to be environmentally compatible?

The Need for Technology Literacy

A major consequence of accelerating technological change is a difference in levels of technological ability and understanding. There is a widening gap between the knowledge, capability, and confidence of the average citizen and that of the inventors, researchers, and implementors who continually revolutionize the technological world. While it is logical and necessary for the developers to have advanced technological capability, it is senseless for the general public to be technologically illiterate.

Because of the power of today's technological processes, society and individuals need to decide what, how, and when to develop or use various technological systems. Since technological issues and problems have more than one viable solution, decision making should reflect the values of the people and help them reach their goals. Such decision making depends upon all citizens acquiring a basic level of technological literacy—the ability to use, manage, and understand technology.

Indeed, technological literacy is vital to individual, community, and national economic prosperity. Beyond economic vitality is the realization that how people develop and apply technology has become critical to future generations, society, and even the Earth's continued ability to sustain life.

Technological Literacy

Technological literacy is the ability to use, manage, and understand technology.

- The ability to **use** technology involves the successful operation of the key systems of the time. This includes knowing the components of existing macro-systems, or human adaptive systems, and how the systems behave.

- The ability to **manage** technology involves insuring that all technological activities are efficient and appropriate.

- **Understanding** technology involves more than facts and information, but also the ability to synthesize the information into new insights.
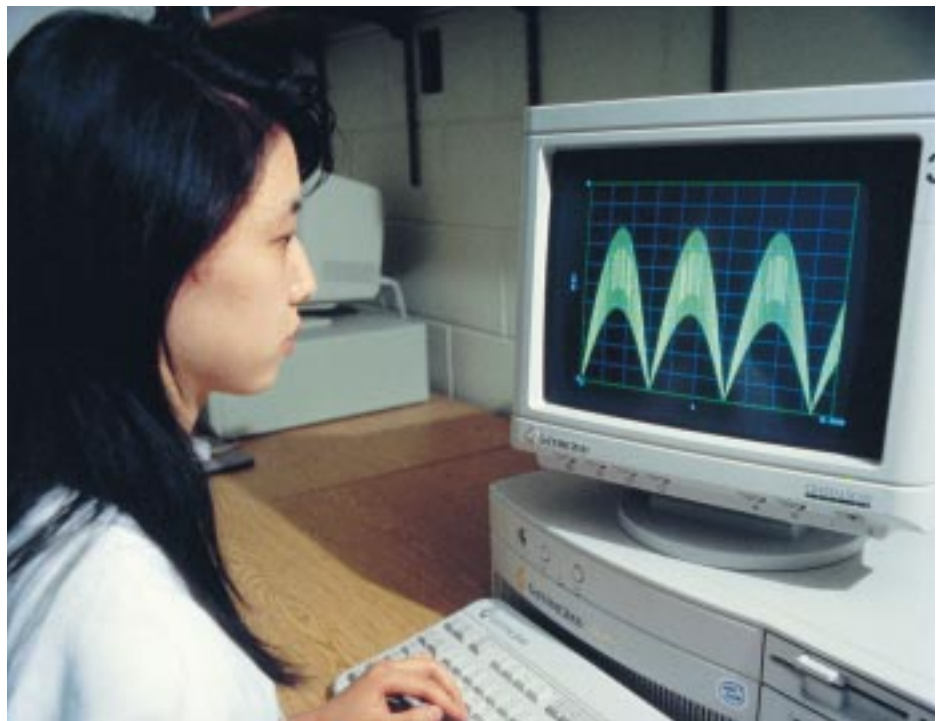
Practically every job today depends upon people learning new technological processes and systems.

Courtesy of Bob Veltri

Courtesy of Alan Brown/Photonics

Retirees have experienced tremendous changes in their lives. The advent of television, satellites, personal computers, genetically altered food, and the threat of nuclear devastation are but some of the changes they have witnessed since they were children. Today's children will experience even greater changes. What will they develop, manage, and adapt to before they retire? Will they have the necessary skills and understanding to direct and adapt to technological change?

Individual Needs

Participating citizens need to consider issues and take part in decisions regarding transportation, land use, pollution control, defense, and restricting or encouraging technological activities. Sound decisions demand an understanding of the impacts, relationships, and costs of such technological activities.

- Workers need to possess a variety of technological abilities—both the skills to use products and the ability to identify and remedy simple malfunctions. Those directly responsible for technological change, such as engineers, designers, consumers, manufacturers, key decision makers, and architects, require an understanding and ability to assess and forecast the impacts of their actions. Workers today also need to have the tools to adapt to technological change in the workplace.

- Consumers need to make decisions about the purchase, use, and disposal of appliances, information systems, and comfort-enhancing devices. From entertainment to medical decisions, everyday life requires a basic technological literacy.

When making informed decisions about how to spend recreational time, consumers often need to consider issues involving safety, effectiveness, and effects on the environment. Such decisions require basic technological literacy.

Societal Needs

More than personal comfort and satisfaction is at stake. Today's global societies must improve their technological literacy in order to support growing populations and to provide a safe environment in a complex world.

- Effective democracy depends on all citizens participating in the decision-making process. The decision-making process safeguards the country from yielding control to a small, powerful elite. Since so many decisions involve technological issues, technological literacy is required for all citizens.

- Technological activities provide the base for the country's economy. As new advances provide more opportunities, the need grows for technologically skilled engineers, innovators, and workers to develop and maintain a competitive edge in a global economy.

- Democracy demands shared responsibilities and contributions. People who lack the technological knowledge needed to participate in the economy often become noncontributing members of society who must be provided for by others.

All citizens should increase their levels of technological literacy so that they can effectively participate in the decisions affecting society. Should new roads be built in agricultural districts? Should logging be restricted in an old-growth forest? How should the airwaves be regulated? Should society underwrite research in developing technologies? These and many more questions can be best answered only if all citizens are capable of participating in the decision-making process.

Environmental Needs

Because various technological processes or abuses can pose ecological dilemmas and create environmental crises, technological literacy is critical to the Earth's continued ability to support life.

■ Innovators, developers, governments, and consumers need to consider the consequences on the environment when making decisions about the use and development of different processes.

■ Everyone must be concerned with the entire product life cycle. They must consider not only the materials and processes used in production, but also what happens to products at the end of their useful life.

■ Designing and developing technological processes and systems that are less threatening to the natural environment has become very important. When it comes to the environment, technology can be viewed optimistically as a means to solve environmental problems, not just create them.

Through technology, people will not solve all of the problems in the future. They will, in fact, create some. But if people develop and use technology in the context of the country's goals and values, they will continue to offer each other even more ways to work, enjoy leisure, communicate, and order their lives.

Courtesy of Bob Veltri

Much technological activity has an impact on the Earth's natural resources. It is imperative that people consider the consequences of their actions on the environment, and strive to minimize damage. People are now working to develop technological processes that can prevent or repair environmental damage.

Characteristics of a Technologically Literate Person

Technologically literate persons are capable problem solvers who consider technological issues from different points of view and in relationship to a variety of contexts. They acknowledge that the solution to one problem often creates other issues and problems. They also understand that solutions often involve trade-offs, which necessitate accepting less of one quality in order to gain more of another. They appreciate the interrelationships between technology and individuals, society, and the environment.

Technologically literate persons understand that technology involves systems, which are groups of interrelated components designed to collectively achieve a desired goal or goals. No single component or device can be considered without understanding its relationships to all other components, devices, and processes in the system. Those who are technologically literate have the ability to use concepts from science, math, social studies, and the humanities as tools for understanding and managing technological systems. Therefore, technologically literate people use a strong systems-oriented approach to thinking about and solving technological problems.

Technologically literate persons can identify appropriate solutions, and assess and forecast the results of implementing the chosen solution. As managers of technology, they consider the impacts of each alternative, and determine which is the most appropriate course of action for the situation.

Technologically literate persons understand the major technological concepts behind the current issues. They also are skilled in the safe use of the technological processes that are lifelong prerequisites for their careers, health, and enjoyment.

Technologically literate persons incorporate various characteristics from engineers, artists, designers, craftspersons, technicians, mechanics, and sociologists that are interwoven and act synergistically. These characteristics involve systems-oriented thinking, the creative process, the aspect of producing, and the consideration of impacts and consequences.

Technologically literate persons understand and appreciate the importance of fundamental technological developments. They have the ability to use decision-making tools in their lives and work. Most importantly, they understand that technology is the result of human activity. It is the result of combining ingenuity and resources to meet human needs and wants.

Technologically literate persons understand and appreciate the importance of fundamental technological developments.

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Technological Systems

A system is a group of interrelated components that collectively achieve a goal.

The basic building block of technology is the system. A system is a group of interrelated components designed to collectively achieve a desired goal or goals. Systems exist on many levels, as shown by the bicycle.

A basic system involving a bicycle is the guidance and control system, which is made up of handle bars, the wheels, brakes, and a rider who turns the handle bars—all working together to guide the bicycle in the desired direction.

A rider on a bicycle comprises another level of a system. That system is used to transport people from one place to another by muscle power. The components include the rider, subsystems of guidance, power, and support (frame, seat, etc.).

The rider on the bike can be part of yet another level of system. When school children ride bikes to school, they are part of the transportation system that conveys students to schools. Other components of the system include roads, sidewalks, school buses and drivers, bus schedulers, parents who drive children to school, students who walk to school, school crossing guards, and others.

Still another level of system is a macrosystem, such as the country's transportation system, which includes all of the people, machines, information, and infrastructure used to move people and goods from place to place. These macro technological systems are often referred to as human adaptive systems.

Technologically literate persons use a strong systems-oriented thinking approach to solving technological problems.

Courtesy of Bob Veltri

The Goal of Technological Literacy for All

How widespread is technological literacy among Americans today? Levels of technological literacy vary from person to person and depend on one's background, education, interests, attitudes, and abilities. However, most people do not even begin to comprehend the basic concepts of today's technological society. Few can fully comprehend the technological issues in the daily news, perform routine technological activities, or appreciate an engineer's breakthrough.

Understanding of and capability in technology traditionally have been ignored, except for those pursuing education and training in technological fields. For most Americans, technological literacy has been left for individuals to gain through their daily activities. However, technological processes and systems have become so complex that the ad hoc approach has clearly failed most Americans.

A massive effort is needed in order to achieve technological literacy. This should involve the schools, the mass media and entertainment outlets, book publishers, and museums. The country's schools must bear the bulk of this effort, for the educational system is the only means by which each child can be guaranteed participation in an articulated, comprehensive technology education program.

Technology education provides an opportunity for students to learn about the processes and knowledge related to technology that are needed to solve problems and extend human capabilities. Incorporating technology education into every school system will require curriculum development, teacher enhance- ment, and dedicated teaching and laboratory space. A number of states and school systems have already established technology programs. These schools provide evidence of high—quality technology education at all levels. The next part of this document describes the structure for what should be learned in technology, and discusses how it can be incorporated into the education programs of all students from kindergarten through high school and beyond.
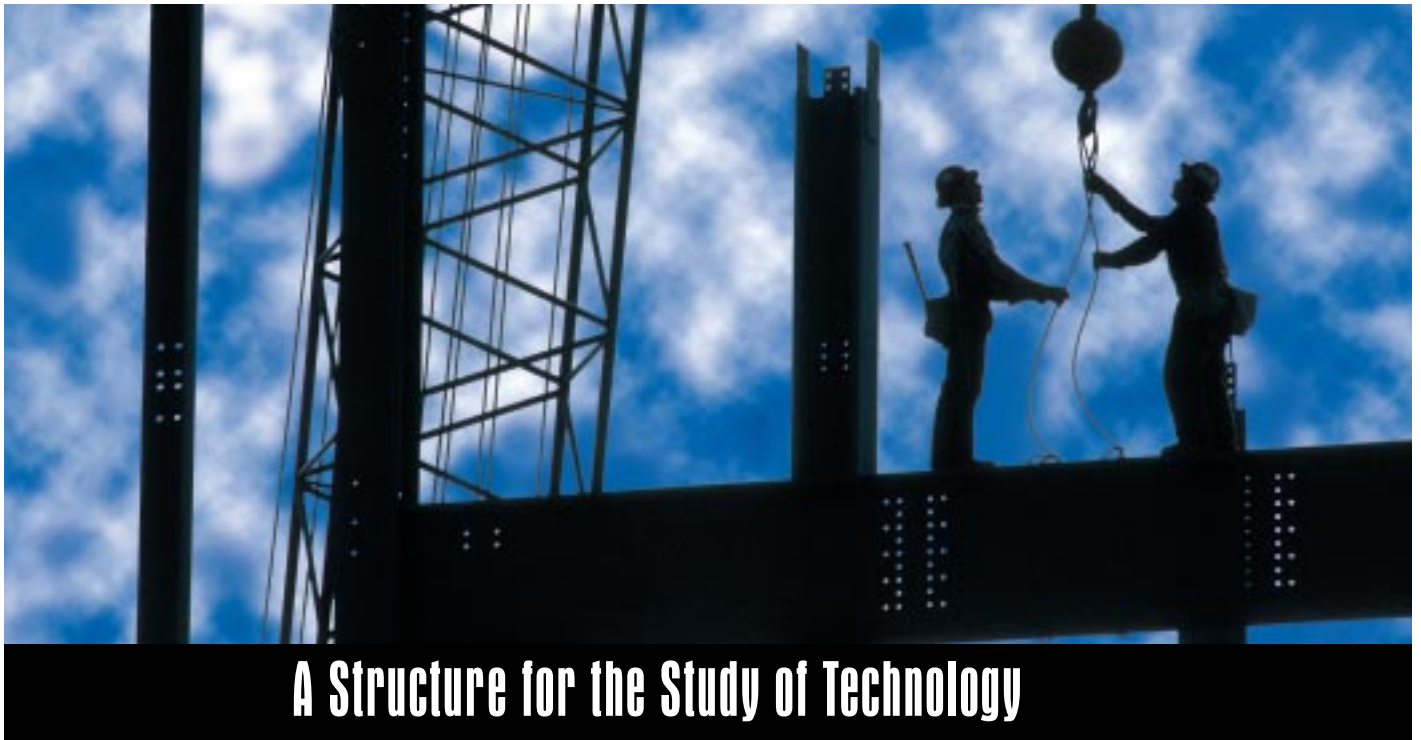
A Structure for the Study of Technology

The Need for a Structure

Agreement on the need for technological literacy is just the beginning. The more difficult problem is determining how to develop this literacy. What experiences, abilities, and knowledge are needed? What exactly should a person know about and be able to do with technology? What should be the content of this literacy effort?

The specific answers change with a person's and community's aspirations, and capabilities. A ranching community in Wyoming encounters totally different issues than a manufacturing community in South Carolina, or a city in the urbanized northeast corridor. The answers also change rapidly with time. Technology is advancing so quickly that knowledge, processes, and systems are becoming obsolete almost as quickly as they are developed. As technology grows more complex, it becomes more important to define and set boundaries for its study.
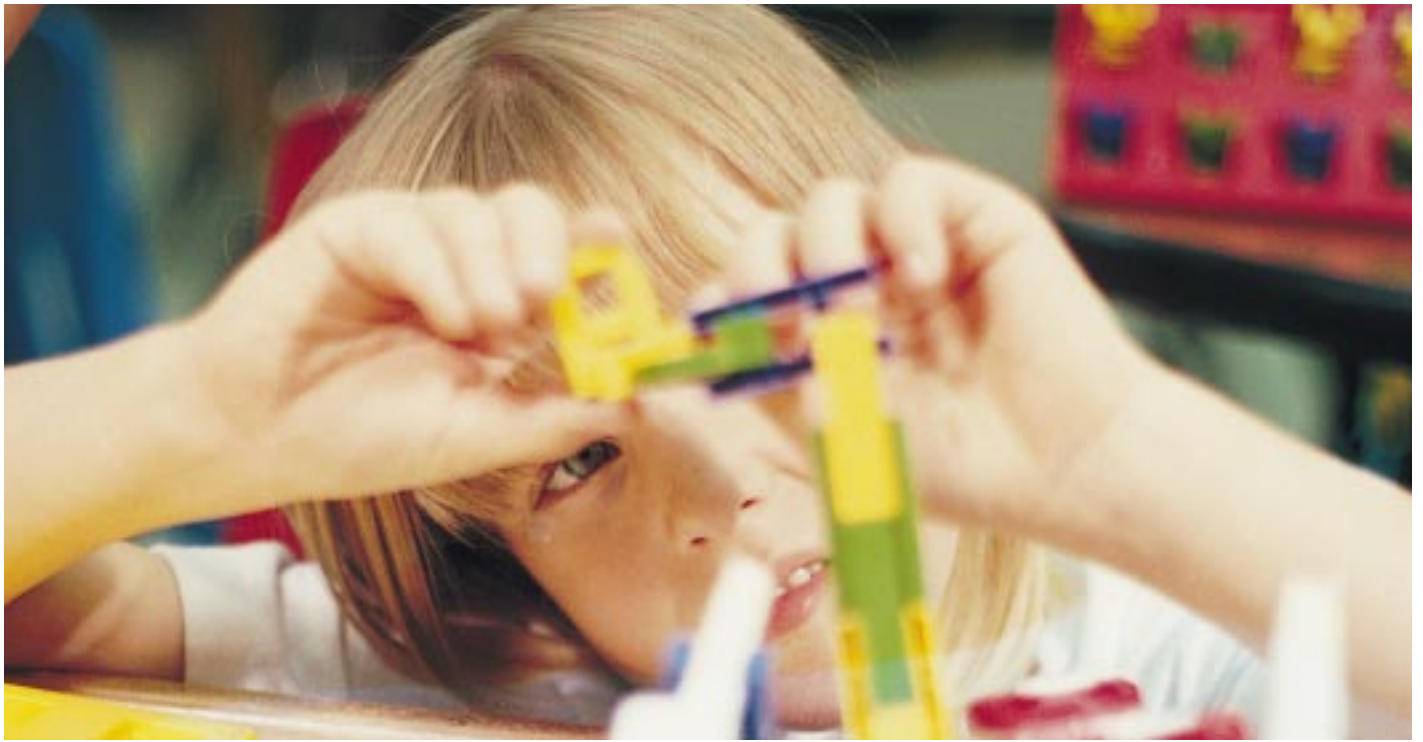
The following pages describe a structure for study that focuses on the universals of technology that are considered to be significant and timeless—even in an era dominated by uncertainties and accelerated change. These universals form the basis for continuous learning of technology throughout a person's lifetime. They constitute the fundamental concepts that allow individuals to continually learn as conditions change. From this proposed structure, the content elements for the study of technology can be developed that will be appropriate for students of different times and places.

Education programs based on this structure will provide students with the concepts and experience necessary to develop the understanding and capability that they will need in a constantly changing technological world.

The Universals of Technology

Technology is human innovation in action. It involves the generation of knowledge and processes to develop systems that solve problems and extend human capabilities. As such, technology has a process, knowledge, and context base that is definable and universal.

The processes are those actions that people undertake to create, invent, design, transform, produce, control, maintain, and use products or systems. The processes include the human activities of designing and developing technological systems; determining and controlling the behavior of technological systems; utilizing technological systems; and assessing the impacts and consequences of technological systems.

Technological knowledge includes the nature and evolution of technology; linkages based on impacts, consequences, resources, and other fields; and technological concepts and principles. This includes much of the knowledge of how the technological processes are developed, applied, and used.

The context of technology involves the many practical reasons why it is developed, applied, and studied. People develop technological processes and knowledge for a reason—they want to develop and use systems that solve problems and extend their capabilities. The systems that are developed can easily be categorized as informational systems, physical systems, and biological systems.

The processes, knowledge, and context are all equally critical to the existence and advance of technology. One cannot exist without the others, for they are mutually dependent. With technological knowledge people engage in the processes, yet it is through the processes that technological knowledge is developed. All technological activity is for a reason, or done within a context.

Processes, knowledge, and context, then, are the universals of technology, and must be the foundation of the structure for the study of technology. Each of the universals is discussed in greater detail in the following pages.

Technology is human innovation in action. It involves the generation of knowledge and processes to develop systems that solve problems and extend human capabilities.

PROCESSES

KNOWLEDGE

Assessing the Impact and Consequences of Technological Systems

Utilizing Technological Systems

Determining and Controlling the Behavior of Technological Systems

Designing and Developing Technological Systems

Nature and Evolution of Technology

Linkages

Technological Concepts and Principles

Informational Systems

Physical Systems

Biological Systems

CONTEXTS

Designing and Developing Technological Systems

Much technological activity is oriented toward designing and creating new products, technological systems, and environments. The technological design process involves the application of knowledge to new situations or goals, resulting in the development of new knowledge. Technological design requires an understanding of the use of resources and engages a variety of mental strategies, such as problem solving, visual imagery, and reasoning. Developing these mental capabilities and strategies so that they can be applied to problems is a significant aspect of technological literacy. These abilities can be developed in students through experiences in designing, modeling, testing, troubleshooting, observing, analyzing, and investigating.

After a product, system, or environment is conceived, it is designed or developed. The development processes include those activities that are used to carry out the plans, create solutions, or to test ideas that are generated through a design process. The development of physical systems involves many of the common manufacturing and production processes. The development of information systems includes basic data manipulation and enhancing actions, such as encoding and decoding.

Architects develop models of their designs in order to communicate the concepts and to identify any conceptual flaws.

In biological systems, the development processes include genetic engineering, agricultural cultivation, manipulating the human immune system, and improving the predictive technologies for diseases. Technological literacy includes an understanding of development processes involved in physical, biological, and informational systems.

Designers and developers of wireless communications use computer simulations to test the signals.

Determining and Controlling the Behavior of Technological Systems

People need an understanding of technological systems that is based on experience and analysis. This understanding forms the basis of systems-oriented thinking that underlies all technological activity. All technological systems — whether they are subsystems of larger units, such as the steering system on a bicycle, or macrosystems made up of many levels of smaller systems — are composed of inputs, processes, and outputs that work together to achieve what could not be achieved individually.

A technologically literate person should not only know what technological systems are, but also how they operate, how they are controlled, and why they are used. Although there are cases where systems work for unknown reasons, systems understanding usually requires a knowledge from a variety of fields, especially science, mathematics, and technology. This knowledge is central to the investigation and determination of the behavior of the individual component parts and devices that are used within a system. Once the behavior of a system is understood, the technologically literate person is able to assess the complete system to judge what necessary control adjustments are needed as variables change or inputs become known.

Analysis is required in order to determine how many systems work. Analysis often uses information from science and mathematics.

Courtesy of Gary Colbert

Many times the best way to determine what is happening in a system is to take it apart.

Courtesy of Virginia Tech

PROCESSES

Classifying Systems

People classify systems in order to discuss them or study them more easily. The classification system used depends upon the purpose. Very often systems are classified according to their underlying scientific principles, such as electrical, mechanical, or chemical. At different times, systems may be classified according to their purpose, such as communication systems, production systems, and others. Sometimes, systems are classified according to their general makeup, such as physical, informational, or biological. Technologically literate people should be able to use and understand a variety of classification systems, so that they can operate within whichever system is most appropriate for the purpose at hand.

Controlling the Behavior of Technological Systems —The Feedback Systems Model

Technological systems involve the interaction of the key components: input, process, output, and feedback. A system's input is the entry of resource materials into the total system. Sometimes it may be viewed as the desired result or action that a system should achieve. The process is the performance of the system, or how the desired results will be achieved by the system. The output is the actual result or what the process produces. A sample of the output is fed back to the comparison device and compared to the desired result to achieve control. This feedback process involves measuring the difference between the actual result and the desired result. If the output and input are different, then an adjustment is made to the process to keep the output at the desired value for which it is designed.

INPUT (Desired Result) → COMPARE → PROCESS → OUTPUT (Actual Result)

MONITOR

FEEDBACK   FEEDBACK
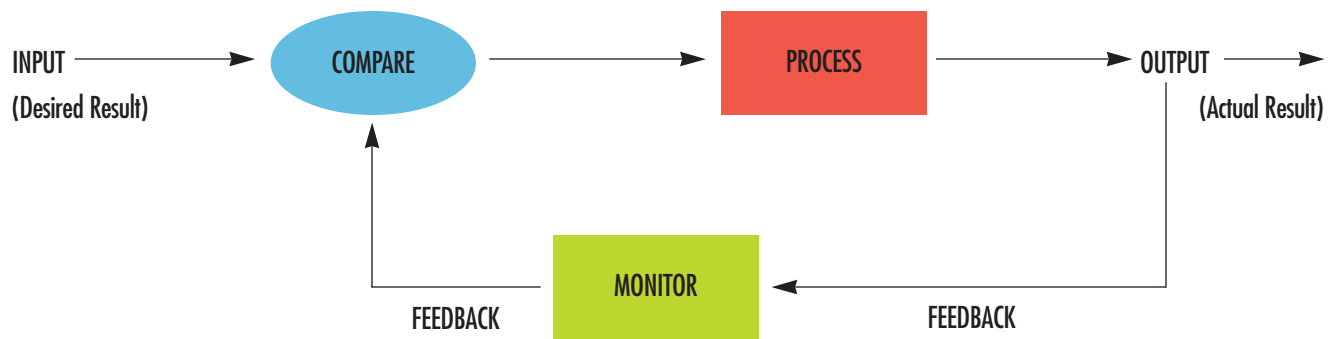
Utilizing Technological Systems

People use technological systems to satisfy their needs and wants. This could be as fundamental as preserving life with food and shelter, to enhancing health and enjoyment. People also use systems that provide them with improved materials, mobility, and communications. Each person should know how to use technology safely and effectively as a means to solve problems and to extend their capabilities.

In order to become safe, effective users of technological systems, people must have experience with the systems that they will commonly encounter at home, play, and at work. Because of the pace of technological change, new developments are quickly absorbed into work and home environments. This means that students will often need exposure to the newest, developing technologies, because the new technologies during their school years will be the common technologies by the time they graduate. In the study of technology, students will need ongoing experiences using various human adaptive systems so that they can:

▪ Select appropriate technologies for the situation,

▪ Use tools, materials, devices, and processes in a correct and safe manner,

▪ Acquire and use information to solve problems and create new technologies,

▪ Analyze system malfunctions,

▪ Adapt to the use of new technologies throughout their life,

▪ Or, in some cases, choose not to employ technological systems in a given situation.

People encounter many different technological processes at work and at home. Effective utilization depends upon safe, appropriate use of systems.

Courtesy of Bob Veltri

Thanks to many technological systems, preparing food can be a quick, easy task. However, in order to select the most appropriate cooking method, the cook must answer a number of questions. Should natural gas, electric, or propane be used for an energy source? Which would be faster, the microwave, convection, or toaster oven? Which process would consume the fewest resources? What is available in the kitchen at the time?

Courtesy of Maureen Heenan

PROCESSES

Assessing the Impacts and Consequences of Technological Systems

People make decisions about technological activities every day. However, the growing complexity of technological systems means that all technological decision-making should include an assessment of the impacts and consequences of an implemented or proposed technological system. All technological activity impacts humans, society, and the environment. Moreover, technological activity involves trade-offs and risks. Decision makers should understand real vs. implied risks associated with technological developments. Erich Bloch, past Director of the National Science Foundation, said that, "Technologically liter-ate people should be able to read a newspaper or magazine article and react to those articles related to technology on a basis of some understanding, not on a basis of emotion." (Bloch, 1986)

Therefore, those involved in the study of technology need experience assessing various technological systems that will affect individuals, society, and the environment. They need to understand the process of assessment so that they can develop their own forecasts. Forecasts are not definite predictions, but are "best guess estimates" based on a variety of techniques, such as trend analysis, modeling, cross impact analysis, Delphi surveys, and scenario development.

Assessing and forecasting processes involve:

▪ Reflecting on historical events and connections,

▪ Determining quality and costs,

▪ Evaluating risks, both real and imagined,

▪ Making decisions on near-term results of current technological activity,

▪ Evaluating the results of changes in current technological activity,

▪ Projecting trends and future developments, and

▪ Anticipating possible consequences.

Not all malfunctions need to be sent to repair professionals. Technologically literate people need to be able to cope with system malfunctions and determine the appropriate course of action.
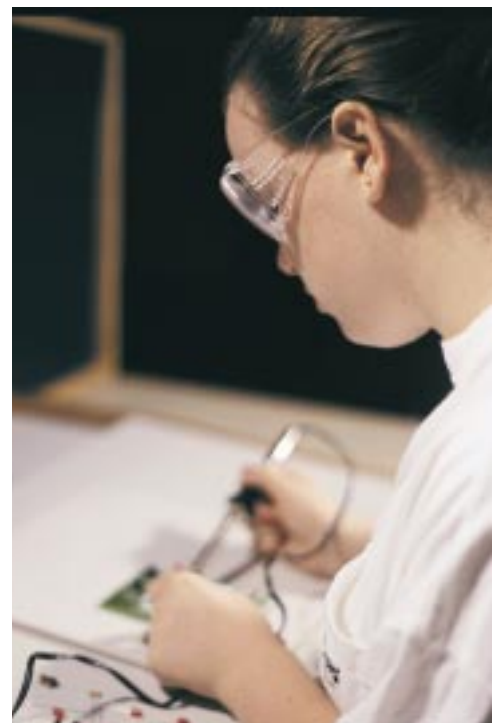
The automobile has had great impact on today's society. The automobile has changed where and how people live, enabling them to create suburbs in areas previously considered out-of-the-way. A huge infrastructure has been developed that includes roads, bridges, service stations, insurance systems, scrap yards, and regulations. The automobile has provided employment for thousands of people who build cars, roads, and bridges. Another consequence of adopting the auto as the primary mode of transportation has been thousands of deaths and injuries each year. Environmental damage from the automobile has been a major problem, especially in more populated areas of the country.

Courtesy of Bob Veltri

Refrigeration for long-haul trucks eliminated the problem of food spoilage during long shipping times—and changed the American consumers' eating habits. The first automatic refrigeration system for long-haul trucks was invented in 1938 by Frederick McKinley Jones, who received more than 60 patents in his career. Jones was inspired to invent the refrigeration unit after talking to a truck driver who lost a shipment of chicken due to heat.

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Courtesy of Henry Ford Museum and Greenfield Village

The first industrial robot, called the Unimate, was put on line in 1961 in Trenton, New Jersey. By the 1990s, robots had been developed to perform many industrial functions , including tasks in hazardous environments such as toxic waste dumps and nuclear facilities.

Courtesy of NY Convention and Visitors Bureau

Construction of the Brooklyn Bridge was completed in 1983 and designed by John Roebling. It was the first great suspension bridge in the U.S.

KNOWLEDGE

The Nature and Evolution of Technology

People need knowledge and an understanding of the nature and a historical perspective of technology. This will help them to understand and analyze current situations and issues, and to challenge and test their decisions about technology.

The nature and evolution of technology is influenced by many factors, including the following:

▪ Needs of society and individual or group desires,

▪ Information base,

▪ Intellectual and social climate,

▪ Education of the citizens,

▪ Social acceptance and compatibility,

▪ Level of development of related technological components, devices, and systems,

▪ Level of talent and expertise available,

▪ Economic capability and desire of society to support technological development, and

▪ Human invention and innovation.

The nature of technology is described by a variety of its characteristics. Technology is developed and applied by people. Its success or failure is usually determined by social acceptance and success in the marketplace. It has helped to satisfy some of the fundamental human needs of hunger, shelter, comfort, health, mobility, and communication,

while at the same time it has helped to create weapons of war and environmental degradation. Technology is ever changing. However, it has grown at an exponential rate over time with many of its major developments taking place in the last few centuries.

Part of the historical perspective of technology is an understanding of significant technological accomplishments throughout history. This can be an immense and significant undertaking. Moreover, what is considered significant may change according to the context in which it is placed. However, substantive technological milestones usually result in a combination of the following:

▪ An alteration of the way people create new products, systems, and environments,

▪ An incorporation of new ways of doing work and recreation,

▪ A widespread and dramatic impact on individuals, social systems, or the environment, and

▪ A significant impact on the progress in other subject fields.

It is important that the nature and evolution of technology be included in the cognitive basis of the study of technology. The nature and meaning of technology has evolved over thousands of years and its understanding is important for each person.

Part of the historical perspective of technology is an understanding of significant technological accomplishments throughout history.

KNOWLEDGE

Linkages

Decisions concerning the development and the use of technology cannot be made in today's world without an understanding of how technology influences and is affected by society and the environment. Individuals, societies, the environment, and academic disciplines all affect technology and, in turn, are changed by new technological developments. These influences and impacts can be positive or negative, anticipated or unanticipated, depending upon the situation.

Understanding the linkages between technology, society, and the environment is particularly important with technology trans-

fer activity. Technology transfer can involve applying a product, system, or environment to a setting or application that is different from the situation for which it was developed. As technological systems are moved from culture to culture, country to country, organization to organization, or government laboratory to private enterprise, what considerations must be made for the interrelated and reciprocal behaviors of technological, social, and natural systems? How will the transfer of knowledge and processes affect the relationships that currently exist between individuals, societies, and the environment?

Technology transfer occurs when a product, system, or environment developed for one setting or application gets utilized in another setting or application.

Technology and Society

TECHNOLOGY AFFECTS SOCIETY AS IT:

- Serves as an economic engine,

- Increases human capabilities,

- Creates new linkages between people, groups, and nations or between people and the environment,

- Introduces ethical and political issues,

- Solves and introduces health and safety issues, and

- Increases environmental problems.

SOCIETY AFFECTS TECHNOLOGY AS IT:

- Influences and limits development and use,

- Provides skills and ideas, and

- Provides the need/demand for bigger, better, faster, more efficient systems.
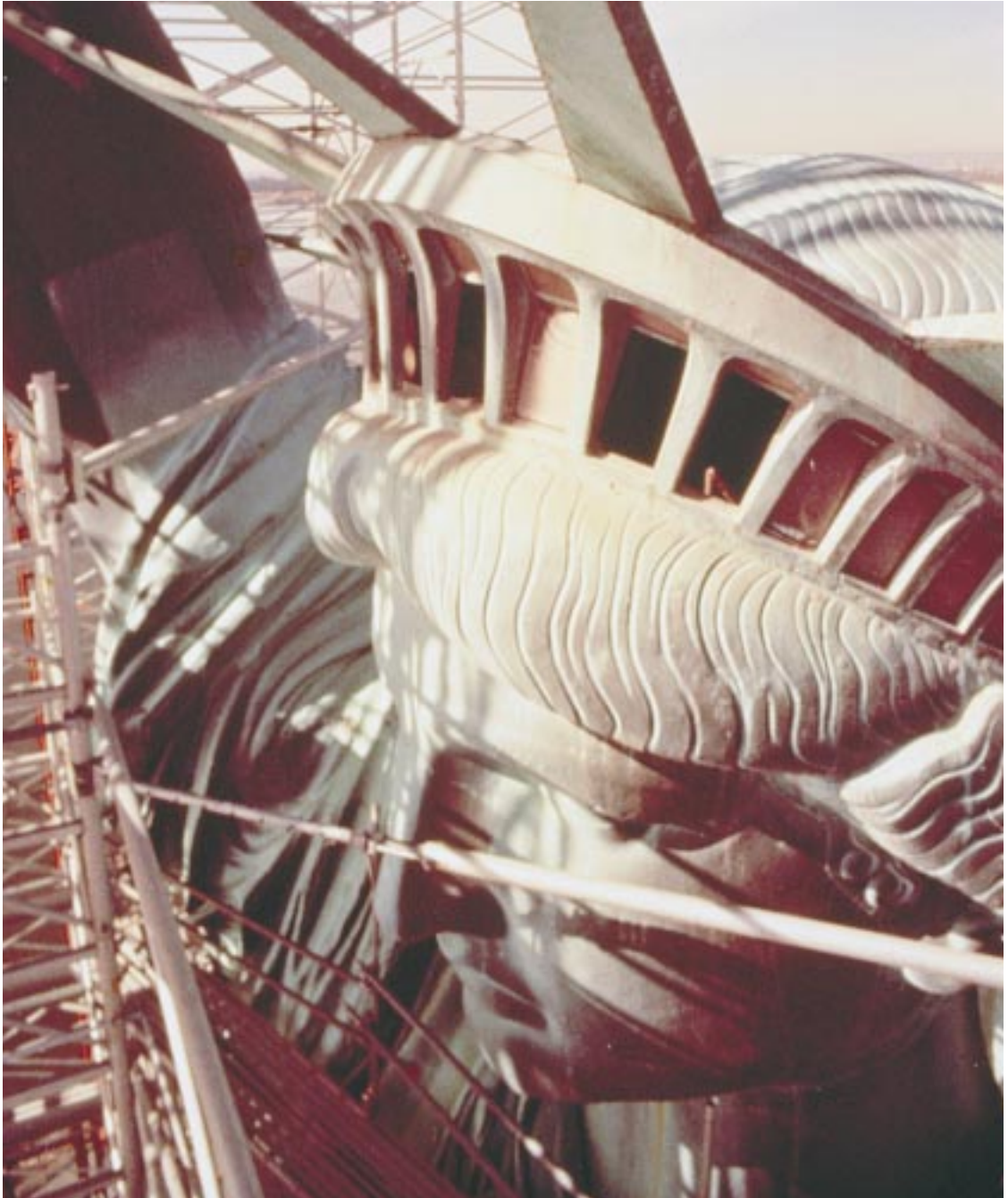
Courtesy of NASA Center for Space Information

Technology transfer occurs whenever systems or processes developed in one setting are used in another. For example, in the early 1970s, NASA had a special coating developed that would protect the launch structures from salt corrosion, rocket exhaust, and thermal shock. More than 10 years later, the same coating was applied to the interior structure of the Statue of Liberty, in order to prolong the statue's life.

KNOWLEDGE

Technology and Other Fields of Study

Progress in all fields of study has been enhanced by technological tools, such as measuring devices or information processing and communication systems. At the same time, technological activity draws on information and theoretical tools from every other field of study. Theoretical tools are basic rules of truth, such as laws, formulae, fundamental principles, axioms, or theorems. Technology has a particularly strong relationship with science and mathematics.

Science is a study of the natural world (National Research Council, 1992), and technology extends people's abilities to modify that world. Science and technology are different, yet symbiotic. Technology is much more than applied science and science is quite different from applied technology. When people use technology to alter the natural world, they make an impact on science. Science is dependent upon technology to develop, test, experiment, verify, and apply many of its natural laws, theories, and principles. Likewise, technology is dependent upon science for its understanding of how the natural world is structured and functions.

Mathematics is a study of all conceivable abstract patterns and relationships (American Association for the Advancement of Science, 1993, Project 2061 Benchmarks for Scientific Literacy). It provides an exact language for technology and science. Developments in technology, such as the computer, stimulate mathematics, just as

Courtesy of Bob Valiri

Music written using a computer is discussed through the use of audio-visual equipment.

Artists use technological systems to produce their works of art. Shown above, an artist creates an image (right) using a computer system.

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developments in mathematics often enhance innovations in technology. One example of this is mathematical modeling that can assist technological design by simulating how a proposed system may behave.

Technology also has interdisciplinary linkages with social studies, language arts, humanities, art, music, and many other fields of study. For example, the sociological and historical aspects of technology are very important in social studies. Likewise, technology has revolutionized the fields of music and visual arts with the recent ability to convert from analog to digital signals.

There are strong philosophical connections between technology and engineering and architecture. Historically, engineering and architecture have had some limited involvement with education in the primary and secondary schools. These professions need to work with technology educators to develop alliances for infusing engineering and architectural concepts at these levels. The alliances will provide a mechanism for greater appreciation and understanding of engineering, architecture, and technology.

Each technologically literate person should know some of the underlying basic science, mathematics, engineering, and architectural concepts and their relationship to technology. Also part of this literacy includes an appreciation and understanding of the interdisciplinary connections between technology, language arts, the humanities, and social sciences.

Technology Education and Educational Technology

Technology education is different from instructional technology, also called educational technology. Educational technology, which involves using technological developments, such as computers, audio-visual equipment, and mass media to aid in teaching all subjects, is concerned with creating the optimum teaching and learning environment through the use of technology. Technology education is a school subject designed to develop technological literacy, while educational technology is used as a tool to enhance teaching and learning. The role of educational technology in technology education is the same as it is in mathematics, science, the humanities, or any other field of study.

Technological Concepts and Principles

A number of concepts and principles can be identified that are central and unique to the study of technology. These concepts must be defined in any technological literacy effort, for they serve as the cornerstones in a field with constantly changing boundaries.

The following concepts and principles are presented as examples, and are not intended to be a comprehensive list.

▍Technology results from human ingenuity.

▍Technological activities require resources.

▍People have created technological systems to satisfy basic needs and wants.

▍Technological activities have both positive and negative impacts on individuals, society, and the environment.

▍Technology provides opportunities and triggers requirements for careers.

▍The current state of technological sophistication is the result of the contributions of diverse cultures.

▍The rate of technological change is accelerating.

▍Complex technological systems develop from simpler technological systems.
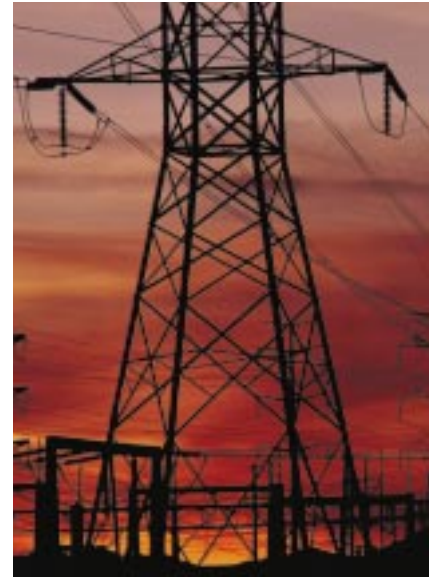
Technological activities require resources, such as energy—whether it comes from the sun, electricity, or other sources.

These concepts are comparable to the basic principles of any field. For example, in science, the key concepts and principles include that organisms use matter and energy for growth and maintenance; that observation and experimentation are the bases of scientific inquiry and discovery; and that the processes that changed the Earth in the past still exist today—the principle of uniformity.

KNOWLEDGE

Technology is the result of human innovation—creativity, knowledge, and skills. Ingenuity depends on a firm understanding of existing technology and the ability to conceive something that does not currently exist.

Since its invention in the eighteenth century, the hot-air balloon has symbolized human ingenuity. With standard materials and creativity, people were able to soar with the birds. Ingenuity is not always appreciated, however. A hydrogen balloon invented about the same time as the hot air balloon stayed up for 45 minutes and covered 15 miles. Then it was destroyed on the ground by terrified observers.

CONTEXT
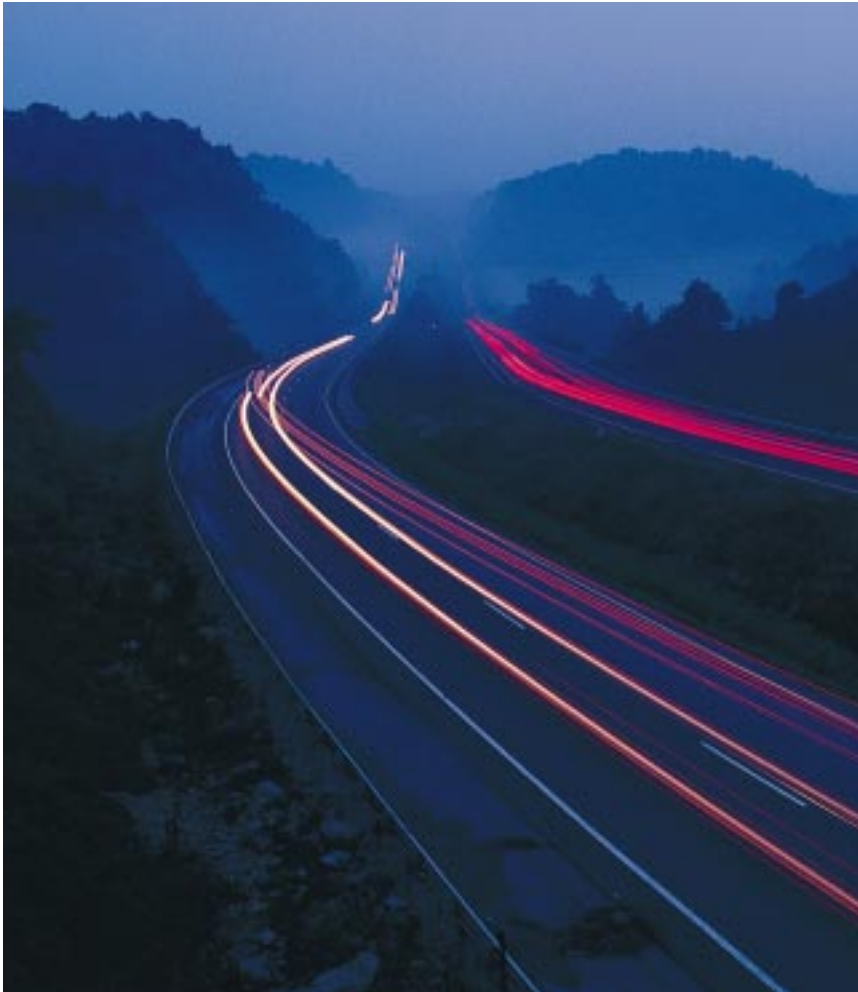
Courtesy of Gary Colbert

Physical systems are among the more obvious results of technological activity. Whether used for transportation, shelter, entertainment, production, or study, physical systems require resources and involve changing the form of materials.

Systems have been developed by people to help them communicate across long distances. The first satellite was launched in 1959, and within 10 years satellites had become a standard method of transmitting voice, data, and video.
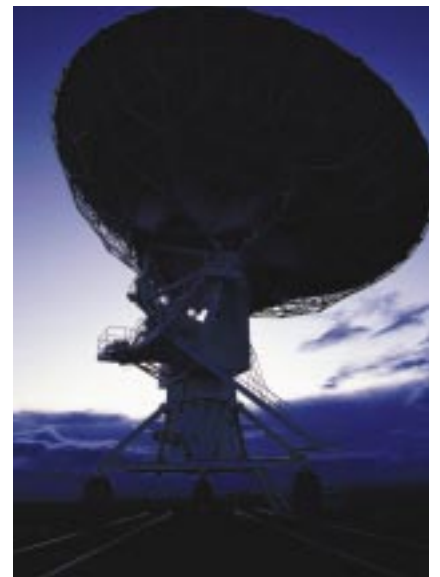
CONTEXT

Systems

The processes and knowledge related to the study of technology must be placed in the context for their development and use. The technological contexts can be categorized as information systems, physical systems, and biological systems. All three types of systems rely on the processes and knowledge outlined in the previous pages.

Informational Systems are concerned with processing, storing, and using data. Such systems provide the foundation for today's "information age." Knowledge of and experience with these systems gives people the ability to quantify, qualify, and interpret data as a basis for developing new knowledge. Communication technology is an information system that provides the interface between humans and humans, between humans and machines, and between machines and machines.
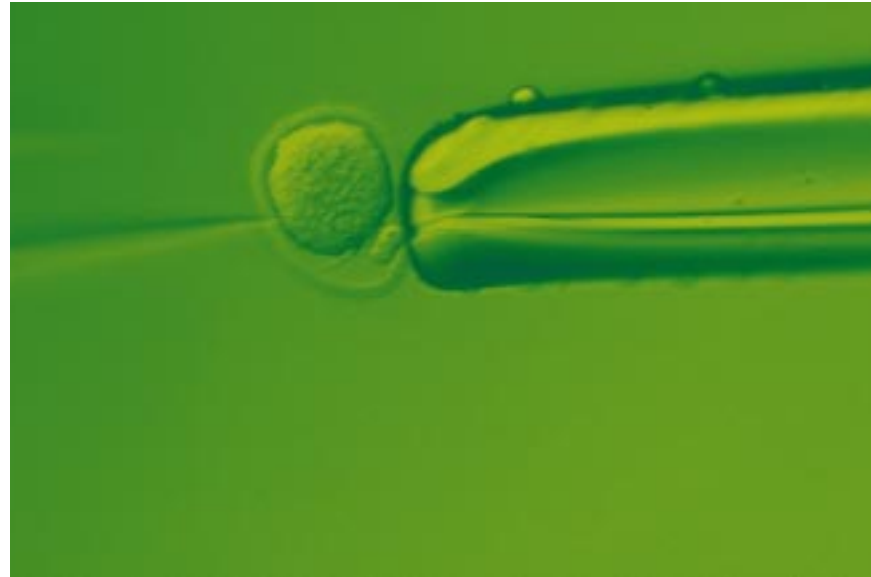

Courtesy of Virginia Tech.

The ability to alter the molecular structure of living organisms has given society great medical advances. However the ability has also caused ethical debates about altering the genetic structure of humans and animals.

Physical Systems are those that are tangible and made of physical resources. Changing the form of materials to increase their value and purpose provide the basis for production in physical systems. Power is considered as a major part of the physical systems since it is important to the operation of them. Physical systems also transport people and things.

Biological Systems use living organisms (or parts of organisms) to make or modify products, to improve humans, plants, or animals, or to develop micro-organisms for specific use (U.S. Office of Technology Assessment, 1988). Many of these systems are referred to as, "biotechnology." Biological systems are used in fields such as agriculture, medicine, sports, and genetics.

Teaching Technology

During a period of educational reform in the 1980s, the late Ernest Boyer, president of the Carnegie Foundation, stated that America needed to develop technological literacy in all students.

The great urgency is for "technology literacy," the need for students to see how society is being reshaped by our inventions, just as tools of earlier eras changed the course of history. The challenge is not [just] learning how to use the latest piece of hardware, but asking when and why it should be used (Boyer, 1983, p 111).

Boyer's prescription is even truer today. School systems across the country must establish effective technological literacy efforts, beginning in kindergarten and continuing each year through high school and beyond. By using the structure outlined in the last section, communities can incorporate the necessary concepts and experiences so that all students have the opportunity to develop the necessary knowledge and abilities to become technologically literate. By incorporating the universals of technology throughout the curriculum and in technology courses, schools can provide experiences that instill insight and problem-solving capabilities. Including the study of technology in the core curriculum will not only raise the technological literacy of the community, but also help students perform better in other sub-

jects. In addition, technological literacy will create a more diverse and larger pool of graduates who are able and motivated to pursue education and careers in the various technological professions.

The first priority of technology education is to provide technological literacy to all students. This includes all of those students who traditionally have not been served by technology programs.

Technology must be a required subject for every student at every level of their education. Incorporating technology education into the country's school systems will require curriculum development, teacher training, and in some cases, dedicated teaching and laboratory space. However, it is an effort that will reap rewards for every person in every community, and society as a whole.

Technology Education During the Elementary School Years

Throughout the elementary years, technology education should be designed to help pupils learn and achieve the educational goals of the total elementary curriculum. These experiences develop the students' perceptions and knowledge of technology, psychomotor skills, and provide a basis for informed attitudes about the interrelationship of technology, society, and the environment.

Beginning in kindergarten, technology education can help deliver the kind of active learning that children need and enjoy. Children should be engaged in the design of products, systems, and environments requiring them to gain new knowledge about technology, and to use the knowledge they have learned from related subjects. Pupils apply their knowledge when drawing, planning, designing, problem solving, building, testing, and improving their solutions to problems. According to research results from cognitive science, this process of critical thinking and creative activity can help children construct what they are learning into more meaningful knowledge structures. Technology education activities can be used to integrate the study of technology with related concepts from other disciplines, such as mathematics, science, social studies, and the humanities.

Technology education should be a part of integrated thematic units that explore the relationship of technology to humans, societies, or

Technology education provides the active learning on which students thrive at all ages.

Courtesy of Bob Veltri

The materials and resources required for elementary technology education are minimal.

Elementary school pupils should apply their knowledge through drawing, planning, building, testing, and improving their solutions to problems.

Courtesy of TIES Magazine

the environment, or incorporated into the elementary curriculum as a valued subject with designated time slots. The materials and resources required for elementary technology education are minimal and include student- and teacher-prepared items, along with basic supplies typically used at these grade levels.

Technology can and should be taught in the regular classroom, by a qualified elementary teacher. Initially, many elementary teachers feel unqualified to teach technology, but experience has shown that with appropriate inservice training, these teachers perform exceptionally well and excel at integrating technological concepts across the curriculum. However, if technology education is to enhance what and how children learn, all elementary teachers will need inservice and preservice opportunities in technology education. Further, all teacher preparation institutions will need to include technology education as a part of their undergraduate degree requirements.

Technology Education During the Middle School Years

Middle school technology education programs should be designed to provide active learning situations that help the early adolescent explore and develop a broader view of technology. Instructional experiences should be organized in ways that correspond to the distinct developmental needs of learners in grades five through eight.

Technology education should be a part of the core curriculum for all learners throughout their middle school years. Programs at this level can be implemented through interdisciplinary teams that include a certificated technology education teacher. In some cases the technology education program will be taught by a certificated technology teacher(s) in a non-team-teaching environment. Middle school technology education programs assist students in learning about the processes that apply to the design, problem solving, development, and use of technological products and systems. Also, students begin to develop the ability to assess the impacts and consequences of these systems on individuals, society, and the environment.

In the middle school, the students gain further understanding of the nature and evolution of technology. Middle school students will deepen their level of understanding related to the technological concepts and principles which are considered important for the generation of new knowledge and processes surrounding technology. Middle school students continue to be given opportunities to see how technology has contextual relationships with other fields of study, such as science, mathematics, social studies, language arts, the humanities, and society and the environment.

Middle school students can produce models and develop real technological products, systems, and environments. They learn how to apply principles of engineering, architecture, industrial design, and computer science to gain a better understanding of technology. By taking core courses in technology education at the middle school level, students will discover and develop personal interests, talents, and abilities related to technology.

As middle school students develop greater capability in science, mathematics, and social studies, they are able to delve deeper into the workings of technological systems.

At the middle school level, activity-based technology education leads to a deeper understanding and capability. Students can better understand the components of many structures, including bridges and buildings by designing and building trusses. The students can also gain experiences in analysis, by measuring and comparing the strength of their various structures. Finally, they can explore forecasting by predicting when their structure will fail so that they can learn from this and build even better structures in the future.

Technology Education During the High School Years and Beyond

Technology education at the high school level enhances the learner's understanding of technology and develops a richer sense of the relationships between technology and other school subjects. This is especially appropriate with courses in which there is a direct application with technology, such as science and mathematics. Other relevant courses could be language, social studies, geography, art, music, and physical education. In some applications, technology education can assist the high school student to learn in an interdisciplinary nature by providing relevance to many other school subjects. Curriculum options should allow students to choose from sequences of courses that extend their studies in specific processes and knowledge in technological systems. Courses such as "Introduction to Engineering" can be taken by 11th- and 12th-grade students in some schools.

High school students' needs for technology education are more diversified than younger students' since their interests and potential career choices are expanding. As a result of taking technology education, students need to:

▪ Evaluate technology's capabilities, uses, and consequences on individuals, society, and the environment,

▪ Employ the resources of technology to analyze the behavior of technological systems,

▪ Apply design concepts to solve problems and extend human capability,

▪ Apply scientific principles, engineering concepts, and technological systems in the solution of everyday problems, and

▪ Develop personal interests and abilities related to careers in technology.

High school students engaged in discussion, problem solving, design, research, and the development and application of technological devices need to study and learn in a technology laboratory. This will ensure a learning environment for efficient and safe work. The technology program at the high-school level should be taught by certificated technology education teachers, individually or in a team-teaching environment.

The ultimate goal is to have every student who graduates from high school to be technologically literate. Some students who study technology in high school will pursue technological careers after graduation, such as engineering, architecture, computer science, engineering technology, and technology teacher education.

At the high school level, students should have the opportunity to take technology education courses that delve deeply into various areas that involve the development, utilization, and assessment of technological systems. Courtesy of Rick Griffiths.

Beyond High School

The technological literacy level of high school graduates should provide the foundation for a lifetime of learning about technology. As graduates pursue post secondary study, they will meet many opportunities to delve more extensively into technology studies.

At the community college level, there are specialized engineering technology programs. These programs may consist of electronics technology and design technology,

as well as many other associate degree programs.

The study of technology at the college and university level is extensive and multidimensional. Typical majors in engineering, architecture, health sciences, and computer science are directly involved with the study of technology. Additional courses related to technology may include agriculture, industrial design, science-technology-society (STS), and technology education.

Some universities offer broad courses in the study of technology as a part of their liberal arts or core offerings to undergraduate students. The courses help to provide students with technological literacy at the baccalaureate levels. Finally, the preparation of technology teachers is an important component of higher education.

Courtesy of Rick Griffiths

Many high school students will pursue technological careers after graduating, such as engineering, architecture, computer science, engineering technology, and technology teacher education.

Taking Action

The Need for Standards

To help achieve technological literacy for the nation, standards should be developed based on the universals of technology and structure described in this document. National educational associations and organizations have developed measures to define and delineate standards for mathematics, science, English, language arts, geography, music, art, social studies, foreign languages, and other subjects. The process of defining such standards is worthwhile because it creates a positive discussion about improving the overall quality of education.

The technology education standards will provide a general framework from which state and local school systems can develop curricula and programs best suited to their students. Standards can provide a guidance for teachers to improve their teaching and their technology education programs. Also, these standards will provide the criteria for student assessment, teacher enhancement and teacher preparation, and improvement of the learning environment.

In developing standards for the study of technology, the fundamental premises are:

1. That standards are needed to establish the requirements for technological literacy for all students from kindergarten through 12th grade;

2. That standards must articulate a shared vision for what the teachers, teacher educators, and supervisors of technology education expect students to achieve through technology education;

3. That standards are necessary to establish qualitative and quantitative expectations of excellence for all students; and

4. Standards can be a means to help those from other fields learn more about technology education.

It is very important that standards be set high enough to ensure that all students can participate fully in society. Special considerations must be made in the standards to assure that all learners benefit from technology education.

Technology educators must hold high expectations for each student and every school. Standards, by themselves, cannot erase the results of poverty, or ethnic and cultural discrimination. It is essential that all students have equal opportunities to study technology and that inequalities in school resources be addressed. It is also important that

safe and supportive environments be provided for the teaching of technology and that schools have an adequate supply of knowledgeable teachers who are motivated and qualified to provide exceptional learning experiences.

In the future, the Technology for All Americans Project plans to develop, validate, and gain consensus on four sets of standards for technology education. These include:

1. Curriculum content standards for students in grades K-12 (with benchmarks at grades 4, 8, and 12);

2. Student assessment standards that include cognitive and process achievement indicators, teacher assessment, and appropriate formative and summative evaluation techniques;

3. Teacher enhancement and preparation standards; and

4. Program standards for school systems and individual schools within that system.

A Call to Action

Technological literacy must become a central concern of the educational system. This will require significant effort involving the schools, individuals, parents, concerned citizens, business and industry leaders, government agencies, and those in the technological professions, such as engineering and architecture, and others concerned about the study of technology.

A rationale and structure for the study of technology has been presented here that should assure that everyone can gain the foundation they need to participate in and adapt to today's ever-changing technological world. These materials should be compatible with the emerging standards for technology education. It is hoped that this will encourage technology education leaders to develop new curriculum materials at the state and local levels. Technology education, as presented here, must become a valued subject at every level.

This document addresses technology education professionals and other educators. Technology teachers must realize their full potential as the key people who can increase awareness of the need for technology education within their local school system. State and local school administrators and curriculum leaders must also mobilize to promote the idea that technology education can become a liberating force as a new basic and multi-disciplinary form of education. Technology teacher educators at the college/university level must expand their teacher preparation and research in the field of teaching technology so that many issues can be addressed with knowledge and understanding. Finally, student organizations, should provide activities that are available to all students to develop leadership at the local, state, and national levels. These activities should reflect the standards of technology education.

Professional associations and groups both inside and outside the technology education profession must work to develop and implement standards for technology education. These standards can be used by state and local school systems to develop high-quality technology curricula and programs, to prepare teachers, and to assess whether or not students are meeting the standards.

Parents need to become familiar with technology education and the benefits it can provide their children. They should become proactive in promoting the study of technology as a core subject. The support from the business and industry community is crucial for the full implementation of technology education in the schools.

Key government decision makers, from the local to the state and federal levels, need to be informed about the benefits of technology education for all students so that their support can be obtained.

The vision of technology education, embodied in this document, and later in the standards, must be shared by all of those who have a stake in the future of all children—not just teachers, but also administrators, policy makers, parents, and members of the general public. This material represents not an end, but a beginning. It is a starting point for universal action within states, districts, and local schools across the country so that technology becomes an essential subject for all students.

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Appendices

Technology for All Americans Project

Introduction

In an effort to increase the technological literacy of all Americans, the National Science Foundation (NSF) and the National Aeronautics and Space Administration (NASA) funded this project to develop a nationally viable rationale and structure for technology education. This effort has been spearheaded by the International Technology Education Association (ITEA) and is called "Technology for All Americans." The project's goal is to offer those who are interested in technology education a clear vision of what it means to be technologically literate, how this can be achieved at a national level, and why it is important for the nation.

The Technology for All Americans Project set out to achieve this goal by establishing a National Commission composed of persons who were especially aware of the need for a technologically literate society. Members represent the fields of engineering, science, mathematics, the humanities, education, government, professional associations, and industry. The 25-member Commission has served in an advisory capacity to the project staff and has functioned independently of both the project and the ITEA. The Commission has served as a vital resource of experts knowledgeable about technology and its interface with science, mathematics, engineering, and education.

A team of six writing consultants was formed from the National Commission. Throughout the process, the writing consultants have represented a wealth of knowledge, extensive background, and a unique diversity that played an important role in the development of this document.

Building Consensus

This document, in draft form, went through a dynamic development evolution as a result of a very structured consensus process. The consensus process has involved a series of workshops, along with individual reviews and comments, that ultimately involved the scrutiny of more than 500 reviewers inside and outside the profession of technology education.

The first workshop was held at the ITEA Conference in March, 1995 in Nashville to gain input from the profession on the formative items in this document. During the initial review process, that took place during August 1995, a draft document was mailed to and reviewed by more than 150 professionals, who were selected via a nomination process. Each state supervisor for technology education and president of state associations for technology education were asked to nominate mathematics, science, and technology educators from elementary through high school levels to participate in a series of consensus-building workshops. The workshops were hosted by seven NASA field centers around the country. The draft document was disseminated to the participants prior to the consensus-building workshop. They were asked to review the draft document, respond to several prepared questions, and provide comments directly on their copy of the draft. At the workshops, participants from 38 states and one territory

were divided into heterogeneous groups that represented the interest groups of those involved (i.e., elementary school, middle school, high school, mathematics, science, technology). These small groups were then asked to respond to prepared questions as a group and come to consensus on the content of the draft document.

Input and reactions from the field were very valuable during the consensus process. Perspectives were shared that had not been discussed in prior writing consultants' meetings. Ideas for improving the draft document were generated from the group synergism and regional philosophies or viewpoints were acknowledged. This input was analyzed to determine the needed changes for its content. Changes then were made to reflect the data from the summer workshops. In addition, these changes were "tried out" with groups throughout the fall of 1995 at state and regional conferences. The project staff found that by focusing on areas of concern identified from the summer review process, the changes that

were made in subsequent versions of the draft document were well received.

Changes and revisions go hand-in-hand with the consensus process. This process continued throughout the fall until a second version of the draft document was disseminated for review in October–December, 1995. This second draft was disseminated to more than 250 people at eight regional locations in the United States. This group contained a large number of administrators. It was felt that an important part of the consensus process includes a "buy-in" component. In other words, if technology education is to become a core subject in the nation's schools, then those who hold the power to enable this vision to become real must be involved in the front end of this process.

Additional efforts were made to expand the audience that reviewed this document by making it available to anyone having access to the Internet. Throughout this project, a World Wide Web home page was maintained in an effort to disseminate timely material. Access to the

draft document became part of the home page in December 1995, and reviewers were invited to fill out a comment and review form on-line and submit it to the project for consideration prior to the final revisions. The final version of this document represents the broad support and input that was provided throughout this consensus process.

Technology for All Americans Project in the Future

After developing a consensus-based rationale and structure for the study of technology, the goal for the Technology for All Americans Project is to develop standards for technology education. This will include kindergarten through 12th grade curriculum content standards with benchmarks at 4th, 8th and 12th grade; teacher enhancement and teacher preparation standards; student assessment standards; and program standards. When these standards are developed and implemented, they will improve the quality of technology education programs in schools in the future.

**International
Technology
Education
Association**

History

The International Technology Education Association (ITEA) was created in 1939 by a group of educators who sought to promote their profession and to provide a national forum for their ideas. Today, the ITEA pursues that same purpose on the international level and has become a powerful voice across North America and around the world.

Since its beginning, the ITEA has been dedicated to ensuring that all children get the best education possible. It serves the professional interests of elementary through university technology educators and promotes the highest standards.

Organization

The Delegate Assembly is the ITEA's basic governing body. Delegates are selected by affiliated state/province/national associations and meet annually at the ITEA International Conference. A 12-member Board of Directors, elected by the membership, oversees the fiscal and program management of the association and adopts policies and procedures accordingly. A professional headquarters staff, located in Reston, Virginia, carries out the day-to-day operations of the association.

Mission

The ITEA's mission is to advance everyone's technological capabilities and to nurture and promote the professionalism of those engaged in these pursuits. The ITEA seeks to meet the professional needs and interests of its members, and to improve public understanding of the profession and its contributions.

No generation of educators has ever needed to be as up-to-date on technology trends as today's practitioners. The ever-accelerating changes in current technologies and the influx of new technologies present major challenges to those teaching about technology.

The ITEA strives to:

- Provide a philosophical foundation for the study of technology that emphasizes technological literacy.

- Provide teaching and learning systems for developing technological literacy.

- Serve as the catalyst in establishing technology education as the primary discipline for the advancement of technological literacy.

- Increase the number and quality of people teaching technology.

- Receive enrichment and reinforcement on the concepts in the sciences, mathematics, language arts, and other subject areas.

- Work with tools, materials, and technological concepts and processes.

- Develop technological answers.

Foundation for Technology Education

The Foundation for Technology Education (FTE) supports efforts to ensure that schools prepare students to live effectively in an increasingly complex society. Its emphasis is on educating a citizenry to think and act from a technological perspective for therein lies strength for the individual, society, and the economy. The Foundation is committed to providing supporting programs for technology education which:

▌ Enhance the knowledge and skills of technology teachers.

▌ Promote collaboration between schools and other sectors of the community to enrich educational resources and support school improvement.

▌ Strengthen effective learning about technology in schools.

The FTE is a nonprofit organization established in 1986 by the International Technology Education Association and governed by a Board of Trustees, which includes educators and leaders from business and industry. The Foundation's program of giving and development is devoted to improving and strengthening the education of each learner through high quality technology education.

The Foundation generates a capability to award scholarships and grants to teachers and future teachers to strengthen technology education. It strives to build a financial base that will provide additional means and encouragement to address technological literacy in schools.

For more information pertaining to the International Technology Education Association or the Foundation for Technology Education, contact 1914 Association Drive, Reston, VA 20191; (703) 860-2100.

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**Technology for
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*Technology is
human innovation
in action*