



The Next Step

Developing Standards for Technology Education

Phase I of the Technology for All Americans Project has produced *Technology for All Americans: A Rationale and Structure for the Study of Technology*, the foundation for developing standards for technology education. The project, funded by the National Science Foundation (NSF) and the National Aeronautics and Space Administration (NASA) to the International Technology Education Association (ITEA), has just received funding for Phase II.

The First Step

The rationale and structure document discusses the power and the promise of technology and the need for universal technological literacy. Universals for the study of technology are presented. The document also describes how technology should be integrated into the core of the curriculum from kindergarten through high school and beyond. Finally, a challenge is made to all concerned to take action to establish technology education standards and make technological literacy a national priority.

THE POWER AND THE PROMISE OF TECHNOLOGY

Technology is a fundamental aspect of human activity. The acceleration of technological change is a constant in everyone's life today. The power and the promise of technology is based on the need for technological literacy—the ability to use, manage, and understand technology. Technological literacy is considered to be critical to the success of individuals, entire societies, and to the Earth's ecological balance.

A STRUCTURE FOR THE STUDY OF TECHNOLOGY

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 location, as well as individual aspirations, career, and capabilities.

The structure developed for the study of technology focuses on *universals* of technology that are considered to be significant and

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timeless, even in an era dominated by uncertainties and accelerated change. As the definition indicates, there is a knowledge and process base for technology that is quantifiable and universal. The technological knowledge includes the nature and evolution of technology, contextual relationships or linkages with other subject areas, and technological concepts and principles. (See Figure 1.)

The processes are those actions people undertake to create, invent, design, transform, produce, make, control, maintain, and use 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. Both the knowledge and processes are critical to the existence and advancement of technology. One cannot exist without the other, for they are mutually dependent. With technological knowledge people engage in the processes; yet it is through the processes that technological knowledge is developed.

People develop technological knowledge and processes in order to create and use systems that solve problems and extend their capabilities. Invariably this involves physical, biological, or informational systems to manipulate the natural world. In other words, people develop technological processes and knowledge within the context of adaptive systems, which are the means that people use to modify nature.

Knowledge, processes, and contextual systems, then, have been identified in this document as the universals of technology, and are considered the foundation of the structure for the study of technology.

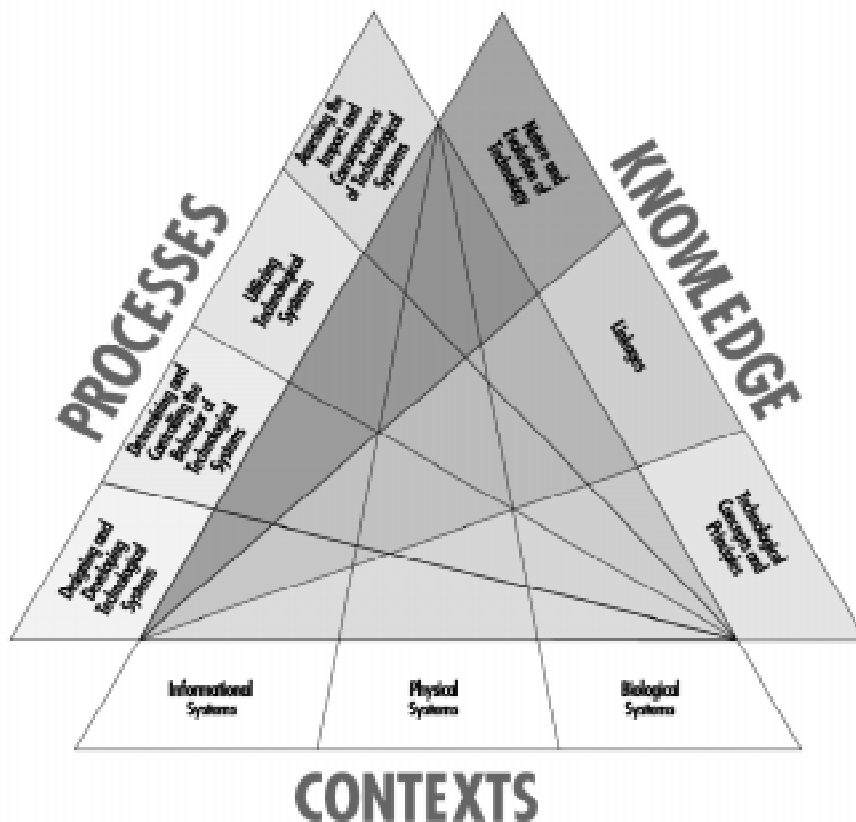


Figure 1. The universals of technology.

Each of the universals is discussed in detail within the rationale and structure document.

TEACHING TECHNOLOGY

School systems across the country must establish effective technological literacy efforts, beginning in kindergarten and continuing each year through high school. By using the structure outlined in the document, communities can incorporate the necessary concepts and experiences so all students have the opportunity to develop the necessary knowledge and abilities. By incorporating the universals of technology throughout the curriculum and in technology courses, schools can provide experiences that instill insight and problem-solving capabilities. Technology should be a required

subject for every student at every level. This vision necessitates curriculum development, teacher enhancement, and in some cases, restructuring building space.

However, it is an effort that will reap rewards for every community in the country. The study of technology during the elementary school years, middle school years, high school years, and beyond should become a national priority.

TAKING ACTION

To help achieve technological literacy at a national level, standards for technology education should be developed based on the universals and structure described in the *Technology for All Americans: A Rationale and Structure for the Study of Technology* document.

The International Technology Education Association and the Technology for All Americans Project provide the support, knowledge-base, and opportunity for groups, agencies, and associations to become involved in the promotion of technology education as an essential core subject in our nation's schools.

Developing Standards

Content standards for grades K-12 will be developed in Phase II within three years (from October, 1996 to September, 1999), with assessment checkpoints or benchmarks at specific grade levels.

TYPES OF STANDARDS

The term "standard" has many meanings. In reviewing the National Council of Teachers of Mathematics (NCTM) *Curriculum and Evaluation Standards for School Mathematics* (NCTM, 1989), it defines a standard as a "...statement that can be used to judge the quality of a mathematical curriculum or methods of evaluation." The National Research Council (NRC) in the *National Science Education Standards* (NRC, 1996) states that "science education standards are criteria by which to judge quality of what students know and are able to do, of the science programs that provide the opportunity for students to learn science, of science teaching, of the system that supports science teachers and programs, and of assessment practices and policies." The Technology for All Americans Project defines standards as "descriptive statements established by key professionals that can be used as criteria for assessing the degree to which technology content, teacher enhancement and teacher preparation, student progress, and programs meet qualitative and quantitative characteristics of excellence."

Two groups will advise and provide input to the Technology for All Americans Project during the development of the K-12 content standards—the Advisory Group and the Standards Team. An explanation of the responsibilities of each group is as follows:

THE ADVISORY GROUP

The Advisory Group will advise the best practice in standards development and to determine ways for the study of technology to be integrated within the total school curriculum. Representatives of the National Council for Teachers of Mathematics, the National Science Teachers Association, the American Association for the Advancement of Science Project 2061, the National Research Council, and a representative from engineering will form an Advisory Group for the Technology for All Americans Project. They will meet semiannually to provide specific advice on the development of the standards and how technology education can be integrated within other school subjects, especially science and mathematics. In addition, consultants will be brought in to provide advice to the staff on the development of the standards. These may include specific personnel who were closely involved in the development of the math standards, science standards, geography standards, and other standards.

The project will develop close alliances with the National Council for Teachers of Mathematics, the National Research Council, the National Science Teachers Association, the National Geographic Society, the American Association for the Advancement of Science, and other associations representing school subject areas. Additionally, the project will create alliances with engineering

and other technology career-related fields in the development of the standards.

THE STANDARDS TEAM

The Standards Team will propose, evaluate, and recommend the content of the standards. In the review and consensus-building process, representatives not only from technology education, but from mathematics, science, engineering, and other school subjects will contribute to the improvement of the standards for technology education as they are developed and modified. The Technology for All Americans Project plans to use a Standards Team comprised of three sub-teams (one team for grades K-2 and 3-5, one team for 6-8, and one team for 9-12) to provide input for the development of standards. The team will be made up of classroom teachers, supervisors, and teacher educators from technology education, as well as elementary administrators and representatives from math, science, and engineering. The leaders of the three sub-teams will be involved in providing input to the Technology for All Americans Project staff who will be responsible for the writing, generating, and consensus-building process for the standards. The first meeting of the Standards Team was held on October 25-28, 1996 at the Xerox Document University in Leesburg, Virginia. At this meeting, the universals were utilized to generate the organizational or broadest level of the standards by benchmark grade level. After this was done, the teams worked on developing first drafts of the more specific or detailed standards, which are concerned with what each student needs to know and be able to do in order to be technologically literate. In some cases, the teams went one step further and developed the most specific level in the hierarchy of standards.



Standards Team meeting at Xerox Document University in Leesburg, Virginia on October 25-28, 1996.

A broad timeline for the three years of Phase II is shown in Figure 2. During the first year of the project (Part A), the focus of the project work will be on developing the hierarchical structure of the standards and then adding content to that structure from grades K-12. During this time, the project staff will work closely with the Standards Team in generating the standards around the universals that were developed in Phase I of the project. The Standards Team leaders will meet in March, 1997 to review the standards. In the late spring, 1997, the standards will be mailed/emailed to a select number of reviewers from technology education, as well as science, mathematics, engineering, and others for review. In the summer of 1997, the Standards Team will meet again to review and refine the standards. During the time from fall, 1997 to the end of 1998 (Part B), the standards will go through a consensus building and further refinement process. Hundreds of people from the technology education profession as

well as from other fields such as science, mathematics, engineering, etc. will review the document by mail or by electronic document review. Consensus hearings for additional reviews will be held at national, regional, and state conferences. In the final part of Phase II of the project (Part C), the standards will be field tested in selected schools in the United States. From all of the input received in many developmental drafts and field testing, the standards will go

through a final editing and will be published in the summer of 1999 (in time to be implemented for the 1999-2000 school year). During this time, the project plans to develop extensive promotion and dissemination activities on the standards in 1998-1999 so that technology education professionals, as well as educators in general, will know what the Technology Education Standards are and how they can assist in improving technological literacy for all children.

THE PROJECT STAFF

The staff will coordinate the total project and work with the Advisory Group, the Standards Team, and the profession in developing, consensus building, and validating the standards. The staff will have the responsibility of research as related to the standards. The staff will work with the ITEA, NSF, and NASA in the overall operation of the project including working with third party evaluators Phi Delta Kappa. Another task of the staff is to assure that the standards for technology education are compatible with other educational standards that are being developed or already exist, especially those in science, mathematics, social studies, and the humanities.

Technology for All Americans

OCTOBER	1996	1997	1998	1999	SEPTEMBER
	PART A		PART B		PART C
	STANDARDS DEVELOPMENT AND REVIEW		STANDARDS CONSENSUS BUILDING AND REFINEMENT		STANDARDS FIELD TESTING, FINALIZATION, PROMOTION, AND DISSEMINATION

Figure 2. Timeline for Phase II.

STANDARDS AND CURRICULUM

It is not the intent of the Technology for All Americans Project to develop curriculum. The standards for technology education will provide a general framework from which states and local school systems can develop technology curriculum that is best suited for their students. The ultimate goal of both quality standards and a well-designed and implemented curriculum should be technological literacy for all students. (See Figure 3.)

In Figure 3, content standards specify what students should know and be able to do in technology. They indicate the knowledge and skills—the ways of thinking, working, communicating, reasoning, and investigating, and the most important and enduring idea, concepts, issues, dilemmas, and knowledge essential to technology—that should be taught and learned in school. They are derived from the Universals of Technology. Curriculum is an operational plan for instruction or the way content is delivered: it includes the structure, organization, balance, and presentation of the content in the classroom. It is the responsibility of the state or locality to develop the curriculum. Again, the

standards for technology education will not develop the curriculum.

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.

Future Steps

It is the long term plan of the International Technology Education Association and the Technology for All Americans Project to develop complementary standards to the K-12 content standards that will address student assessment, teacher enhancement and teacher preparation,

and program assessment at the individual school and/or school system level. A systemic structure of all of these various types of standards and the audiences that are affected is shown in Figure 4.

Note that the content standards in technology education relate directly to the student as the audience. They reflect what every student should know and be able to do in technology. More specifically, they indicate the knowledge and skills—the ways of knowing and doing. Curriculum content standards should directly reflect the most important and enduring of the universals of technology. Assessment standards, which are sometimes referred to as performance standards, will specify the degree to which content standards have been attained in the performance of the student. The National Education Standards and Improvement Council (NESIC) states that performance standards indicate both the nature of the evidence (such as a project, portfolio, research paper, completed design brief, etc.) required to demonstrate that the content standard has been met and the quality of the student performance that will be deemed acceptable. (NESIC, 1993, iii.) Diane Ravitch in her recent book *National Standards in American Education* stresses the need for both content standards and performance (assessment) standards by saying that “content standards without performance standards are meaningless. Content standards define what is to be taught and learned; performance standards describe how well it has been learned.” (Ravitch, 1995, p. 13.) The Technology for All Americans Project proposes that the assessment standards for technology education will be developed later in the project after the content standards are created and validated.

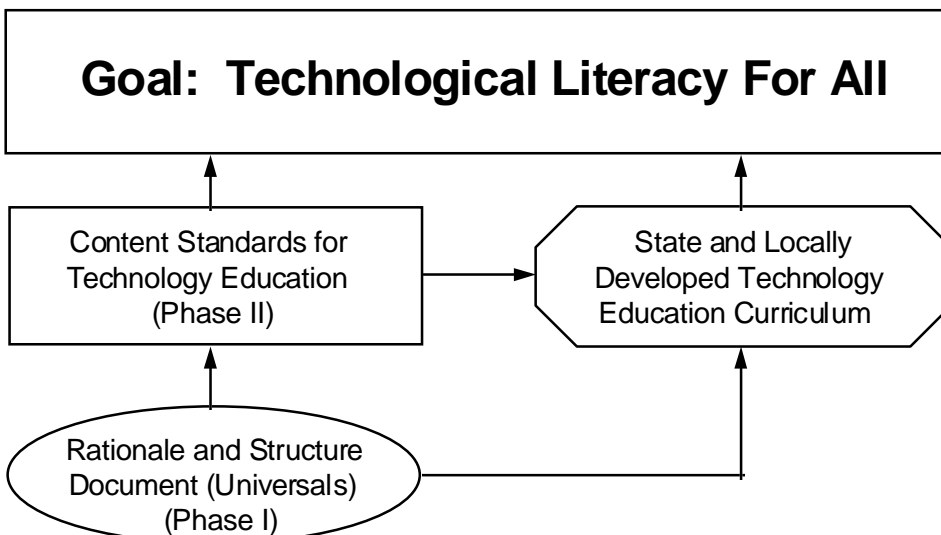


Figure 3. Relationship of Technology for All Americans and state/locally developed technology education curriculum.

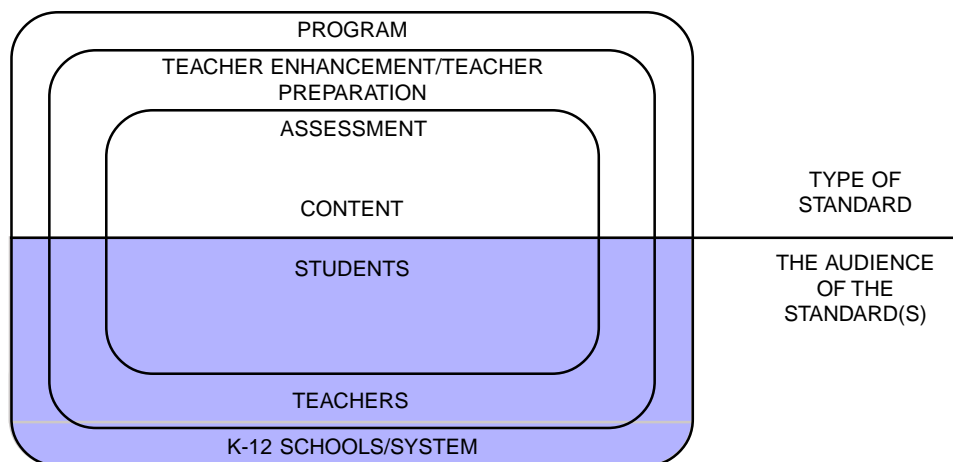


Figure 4. Systemic Structure of Types of Technology Standards and the Audience of the Standards (adapted from Pratt, *The National Science Teacher*, October 1995, p. 24).

The Technology for All Americans Project also proposes to develop program standards for technology education. Adequate resources, such as facilities, equipment, and supplies/materials are central to a quality technology education program. Program standards will provide a framework for assuring quality district level or school level programs in technology education. This framework will provide criteria on all elements of the K-12 technology education program that are consistent with each other and which are articulated within and across each grade level. The technology education program should be coordinated with other school subjects to promote interdisciplinary learning. The Technology for All Americans Project will utilize the *Standards for Technology Education Programs* (1986) as a key resource in developing new program standards.

In addition to developing content standards, assessment standards, and program standards, the project proposes to create teacher enhancement and teacher preparation standards. The teacher enhancement standards will present the criteria for inservicing the existing elementary and technology teachers in the classroom/laboratory. Standards will

be developed that will provide criteria to be used in making judgments about the quality of professional development opportunities (pre-service for new teachers of technology education). This is very important since many states are already experiencing a shortage of qualified and certificated technology education teachers.

In Conclusion

This article has presented the background of the International Technology Education Association's Technology for All Americans Project. It has presented the accomplishments in Phase I with the creation of a *Rationale and Structure for the Study of Technology*. In addition, an overview was presented on the plan for Phase II of the project to develop the standards for technology education in grades K-12. Also, the generation of future standards for student assessment, program review, teacher enhancement, and teacher preparation was discussed.

The ultimate vision of the Technology for All Americans Project is to present a foundation for what every student should know and be able to do with technology to be technologically literate. All of us have a stake, as individuals and as a society,

in technological literacy. Without technological literacy, we have the potential of a chaotic future. With technological literacy, people can use technological knowledge and processes to make sound personal decisions and to participate in discussions of technological issues that affect society and the environment. The real hope and promise of the future lies not in technology alone, but in the people's ability to use, manage, and understand it. ♦

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