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Standards Development as Part of the Technology for All Americans Project

The school reform issue that really matters to make positive changes in education is not vouchers or charter schools, or breaking the unions, or even rewiring the classrooms. It is developing standards that will have a lasting impact to improve the quality of education in every town, city, and state in the country. (Mosle, 1996)

The International Technology Education Association (ITEA), with funding from the National Science Foundation (NSF) and the National Aeronautics and Space Administration (NASA), created the Technology for All Americans Project (TfAAP) to develop standards for technology education across the country. A cross-disciplinary perspective is provided by the TfAAP Advisory Group consisting of people who have been through the process of creating standards for their own fields of study. The role of the group has been to advise the project staff of the best practices in standards development and determine ways for the study of technology to be integrated into the total school curriculum. Using their input, TfAAP has gained important insight into the methods that have worked in the past and those that have not. The project examined and adapted some of the same procedures that other standards groups used in developing, gaining consensus, and validating their own standards. The Advisory Group has provided a wealth of knowledge and experience that the project can utilize. They meet semiannually to provide input to the project staff.

This actual report discusses standards in general, the importance of standards for technology education in the schools and teachers' education, and a review of the project's activities. The project's central goal is to promote technological literacy in grades K–12.

The Power of Standards

More than 15 sets of educational standards have been developed by agencies and professions in the United States. These are usually in specific subject matter disciplines, such as science, mathematics, geography, and economics. Documents describing national standards are valuable resources for states and local school systems to use as they write or revise their own standards.

During his March 1998 speech at the ITEA conference in Fort Worth, Texas, Rodger Bybee, former executive director of the Center for Science, Mathematics, and Engineering Education at the National Research Council, said:

The power of standards lies in their capacity to change fundamental components of the educational system. This assertion has several key points. First is the capacity to cause or influence changes. To be clear, standards imply change, not an affirmation of the status quo. Second, the changes are in fundamental components of education, by which I mean curriculum content, instructional techniques, assessment strategies, and teacher education and professional development programs. Third, I refer to a larger educational system, as opposed to one component such as assessments. A feature of standards is that they influence the entire educational system by specifying outcomes, "What should all students know and be able to do?" In educational history, clarifying educational outcomes is a shift in emphasis. It varies considerably from our common emphasis of modifying inputs in hopes of improving educational outcomes. With reference to inputs we change, for example, time (length of school days, years), content (additional courses), materials (new textbooks or activity-based programs), and techniques (cooperative groups, project-based learning). These inputs are meant to enhance student learning and they may do that, but there is also the reality that to be optimally effective, all of the educational inputs have to be directed to a common purpose. If not, there is the significant possibility of uncoordinated and unfocused changes; for example, in textbooks and teaching techniques. It should not surprise educators that after establishing standards, which are policies, citizens ask for instructional materials, educators ask about teacher education, evaluators ask for tests, and so on.

Most of the national standards focus on the development of content standards. These specify the essential knowledge, skills, and habits of mind that should be taught in school. These standards are often set by local, state, and national groups (Harris & Carr, 1996). Content standards are not curriculum. Curriculum is the way the content is delivered, which includes the organization, balance, and presentation of the content in the classroom and laboratory. Standards are voluntary and not a federal policy or mandate. If they are designed properly, standards should present the content with an articulated rigor in grades K–12. They should take into account what all students should know and be able to do to be literate in that subject.

Joan Ferrini-Mundy (1998), who worked with the National Research Council, made the following comments about standards in *The Science Teacher*:

The Curriculum and Evaluation Standards for School Mathematics (National Council of Teachers of Mathematics, 1989) was published nearly 10

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years ago. The mathematics community has had years of experience with standards and is currently involved in revision of the original standards documents. Standards, no matter how clearly written and carefully designed, are not usually instituted intact in classrooms, textbooks, or policies. Instead, individual teachers, school districts, state framework builders, and curriculum developers are left to interpret standards according to their own needs. For example, one of the perspectives most frequently attributed to the National Council of Teachers of Mathematics (NCTM) standards is that all new mathematical ideas should be introduced via a “real world” context. This is controversial for many reasons: most significant, perhaps, is the concern that such “real world” contexts might be trivialized. In my searches through the NCTM standards, however, I did not find repeated exhortations for such contextualization. What I did find is a clear call for instruction to “be developed from problem situations” (NCTM, 1989, 11), with an emphasis on problem situations that are familiar. (pp. 27–29).

Standards for Technology Education and Curriculum and Classroom Practice at K–12 and Teacher Education Levels

In the October 21, 1998, issue of *Education Week*, Christopher T. Cross, president of the Council for Basic Education, stated:

I am often asked in forums across the country whether standards are here to stay or simply a passing fad that will soon be replaced by another fad. My answer remains firm and consistent: Standards are here to stay. The effort has survived almost a decade of attempts to sabotage it and, in fact, public support is stronger than ever.

Cross (1998) believed that most policymakers in education have yet to understand that content standards are only the first step in the process that involves curriculum revision, assessment standards, program standards, teacher in-service standards, and teacher preservice standards. There must be close collaboration between all of these components to assure that the standards will act as a positive catalyst for reform across the educational spectrum. The bottom line will be whether student learning is improving.

Each state and locality must examine their programs to ensure that they are developed around the Content Standards for grades K–12. If they are not, efforts must be made to design, plan, and implement a technology education curriculum that provides technological literacy for all students. This curriculum must build in rigor with the content ranging from very basic for elementary students to detailed and comprehensive for high school students. All teachers will need a comprehensive professional development education to assist them in properly implementing the stan-

dards-based curriculum. Additionally, an adequate infrastructure for teaching technology education as a field of study essential to everyone is needed. This includes up-to-date facilities, equipment, supplies, and financial support to provide a quality technological studies program in a safe and healthy environment that motivates students.

It is essential that teachers, with input from parents, the community, and business groups, are involved in the planning and development of the new standards-based curriculum. They must “buy into” the changes being made and have ownership in the new curriculum that they will deliver each day in the classroom and laboratory.

Working with elementary teachers to include technology education as a “core subject” within their curriculum will require special efforts. Many teachers (and their administrators) consider their “plates full” with what they currently teach. Elementary school teachers must realize that technology involves much more than products and computers. They should be informed that technology has its own intellectual domain, which every student should learn along with science, mathematics, language arts, and social studies. The study of technology can assist teachers in creating an interdisciplinary environment, which is motivational and exciting to all students. Experiential learning is a hallmark in technology education; it provides students with tactile, active learning experiences that add meaning to cognitive knowledge. Students learn teamwork by working in groups to solve problems. The study of technology makes learning exciting and relevant to the real world.

The Challenges Evoke “To-dos”

With the growing shortage of technology education teachers and the number of teacher preparation programs diminishing, Technology Content Standards will have a major impact on college and university technology teacher education programs throughout the country. These programs will need to study Technology Content Standards and revise their curriculum and teaching methodologies to reflect the vision of the standards. This will involve college and university faculty members in technology teacher education becoming actively involved in and informed about the Technology Content Standards and what they mean for enhancing the technological literacy of all students in the future.

The NCATE accreditation guidelines need to be revised to reflect Technology Content Standards. State and regional evaluative crite-

ria need to be changed based on the Technology Content Standards. A Council of Technology Teacher Education (CTTE) yearbook, *Implementing the Technology Education Standards for the Preparation and Certification of Technology Education Teachers*, is being created. The yearbook will be released in 2002.

In the first phase of the project, *Technology for All Americans: A Rationale and Structure for the Study of Technology* (TfAAP, 1996), was published. It defines the need for standards for technology education and showed how technology can be studied. Phase I helped to build consensus on issues concerning technology education. During the three years of Phase II, standards are being developed for technology education for all grade levels. After four drafts and several reviews, *Standards for Technology Education: Content for the Study of Technology* is scheduled for publication in 2000.

In addition to Technology Content Standards, there is also a need to develop student assessment standards, program standards, and professional development standards in technology education. Currently, there are no other agencies or associations developing these standards from a national perspective. There is an acute need for developing a cadre of teachers, curriculum developers, teacher educators, and administrators who can effectively lead educational reform and implementation in technology education. The need for standards and supportive materials is imperative to prepare future citizens who are technologically literate. Ideally, the goal and objectives of TfAAP will provide the necessary developmental leadership to fully actualize all of the content standards for technology education in the United States.

When funding for Phase III is received, ITEA/TfAAP will be able to work on the following objectives:

- Develop teacher enhancement (in-service) and teacher preparation (preservice) standards based on the Technology Content Standards.
- Develop student assessment standards based on the Technology Content Standards.
- Develop program standards that are used as criteria to assess the quality of and conditions for technology programs in schools based on the Technology Content Standards.
- Develop a cadre of teachers, curriculum specialists, and administrators who can effectively lead reform and implemen-

tation of the Technology Content Standards for grades K–12.

The first objective of the ITEA/TFAAP proposal for Phase III involves developing Teacher Enhancement (in-service) and Teacher Preparation (preservice) standards. In Phase III, the teacher enhancement and teacher preparation standards will be developed and validated from December 1999 to September 2002. If funded, they will deal with providing the guidelines for in-service for elementary and secondary school teachers already in the classroom and laboratory. Additional standards will be developed that provide criteria to be used in making judgments about the quality of professional development opportunities in the preparation of teachers (preservice for new teachers in technology education). This is very important since many states are already experiencing a shortage of qualified and certified technology education teachers. The teacher enhancement and teacher preparation standards will address the education of technology education professionals as well as other educators, especially at the elementary school level.

Hearings will be conducted at the ITEA and other conferences in 2000 and 2001, and these standards will be mailed to members of ITEA's Council of Supervisors (CS) and CTTE to gain consensus. Technology teacher educators at the college and university level must expand their teacher preparation programs and conduct more research in the field of technology education so that many issues can be addressed with knowledge and understanding. The teacher enhancement and teacher preparation standards will hopefully be infused into ITEA/CTTE/NCATE Technology Education Specialty Area Guidelines. Also, TfAAP will work with state supervisors and state accrediting agencies to incorporate the teacher preparation standards in each state. The regional accrediting associations will be contacted to ensure that the evaluation criteria they use will include Technology Content Standards. TfAAP plans to include these concepts in the teacher enhancement and teacher preparation standards for technology education.

The project will use three teams of professionals to develop and improve the standards in the objectives. Refinement and consensus will be made on the standards through hearings, electronic document review on the Internet, and a mail review process sent to select educators and professionals in technology education, science,

mathematics, and engineering. Objective 4 will be accomplished through presentations and workshops nationally, as well as in the states and localities.

The potential impact of Phase III activities along with Technology Content Standards is significant. Any efforts to develop content standards without developing a means of student assessment, assuring a proper laboratory environment, and developing teachers who are properly educated to use the standards are unlikely to succeed. As with the National Council of Teachers of Mathematics (NCTM), the National Research Council (NRC), and others, the formulation of these supportive efforts in standards for student assessment, teaching environments or programs, and professional development should be logically done by the developers of content standards.

The ITEA/TfAAP has developed a Technological Studies Series: Grades 6–8, which will focus on how to implement the Content Standards for technology education. Also it is currently working on a Technological Studies Series: Grades 9–12.

ITEA also has created the Center to Advance the Teaching of Technology and Science (CATTS) to help implement the standards. CATTS is dedicated to providing professional development support for technology teachers and other professionals interested in technological literacy in education. CATTS initiatives will be directed toward four key goals:

- Developing standards-based curricula.
- Enhancing teachers' backgrounds in technological literacies.
- Researching, learning, and teaching.
- Implementing and diffusing changes.

The center will address these goals to

fulfill its mission to serve as a central source for quality professional development support for the teaching and learning of technology and science.

A resource development plan for supporting the delivery of curriculum that is related to developing technological literacy has been developed by CATTS. The plan shows the relationship between the Rationale & Structure, Technology Content Standards, Student Assessment Standards, Teacher Enhancement Standards, and Program Standards. CATTS is developing a Model Curriculum Plan that will help with curriculum development at the state and local levels. Next, the plan shows the relationship between Technological Studies Series for implementing standards at the K–5, 6–8, and 9–12 grade levels, the Model Curriculum Plan, and the curriculum/instructional measures available in the future for grades K–12.

Professional development activities have begun to advance the standards. An ongoing series of in-service programs will be conducted in the next decade. Work has just begun on courses dealing with standards as a part of university offerings. Plans are now underway to use various Internet technologies to create an interactive relationship with teachers. Listserves have already been formed to create this interaction and will also include the ability to view documents that facilitate the implementation of the standards.

Depending on funding, another component of implementing the Technology Content Standards will be a series of “Train-the-Trainer” workshops that the project staff will conduct at 11 NASA Centers during the summer of 2000. These will be one and

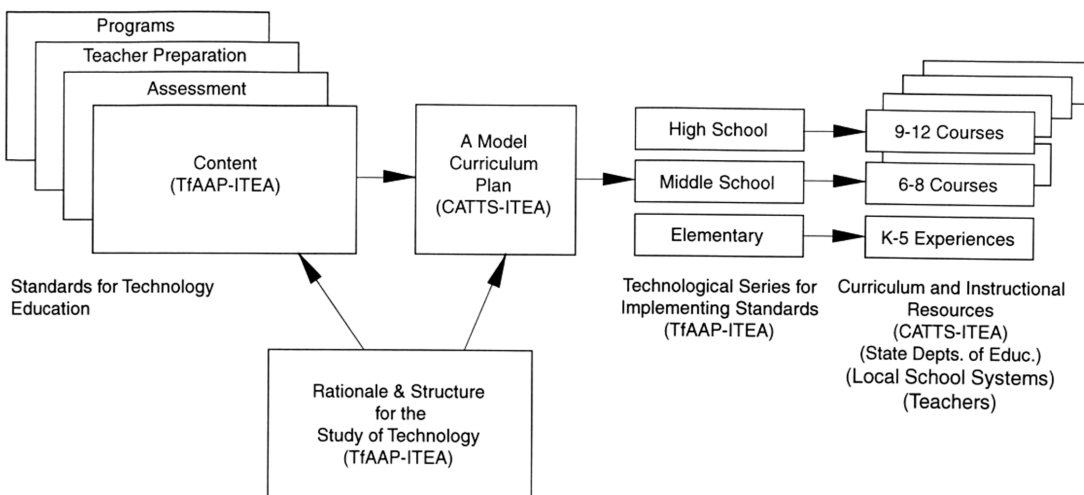


Figure 1. Flow chart for showing phases of the TfAAP project.

one-half day sessions that will focus on what the standards are, how they can be implemented at the state and local levels, and how curricula can be developed around the standards. Each state will be asked to provide nominations for participants who will attend these workshops.

In closing this report, the following ideas need re-emphasis:

Technology Content Standards present a shared vision of what students are expected

to know and be able to do in order to be technologically literate.

Technology Content Standards do not represent an end, just a beginning. Developing the standards may be the easier task; the difficulty lies ahead in achieving the acceptance and implementation of the standards in grades K–12 in every school. It is only through the combined efforts of each of the key decision makers that we will be able to ensure that all students are technologically literate.

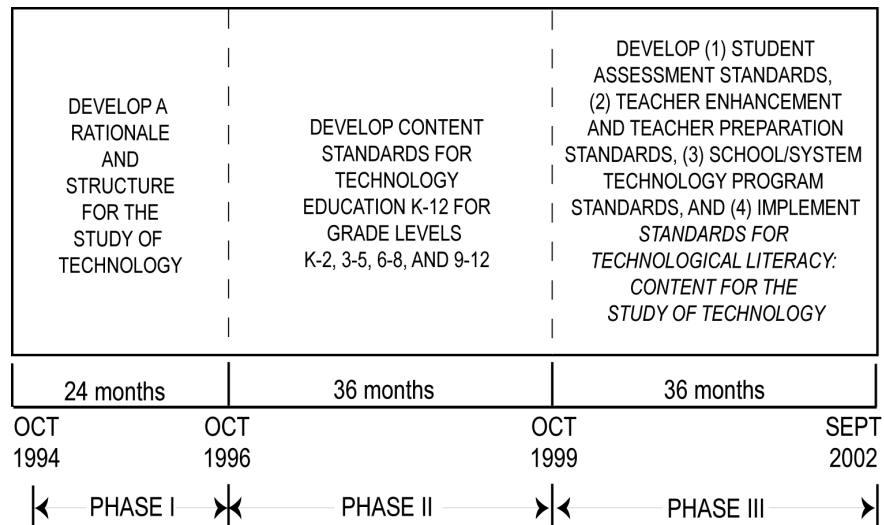


Figure 2. Timeline for phases.

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