# The Perspective of Technology Education

## A Paper given at the Japanese International Symposium on Educational Cooperation for Industrial Technology Education, July, 2008

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### 1. Introduction

The study of technology has been part of worldwide education since the 1930's. In some countries, this began as a study of industry while in other countries it was taught through a study of crafts or the study of work. Some earlier titles for this part of education included "Industrial Arts", "Craft and Design", "Textiles and Work" , "Industrial Education" and other titles. Some countries still use titles such as these to describe this part of education today while others have adopted and use the more contemporary title of "Technology Education".

This paper will offer some evidence that the term technology is a very misunderstood term today; it will discuss the current study of technology in education by defining and clarifying some basic terms such as technology, science, and technological literacy; it will present some dialogue on the difference between "Technology Education" and "Information (sometimes called instructional or educational) Technology;" it will provide some logic on how the content for the study of technology is provided in a document published by the International Technology Education Association (ITEA) titled *"Standards for Technological Literacy: Content for the Study of Technology" (STL)*; and finally it will offer some thoughts on what the future may offer in the study of technology.

### 2. Confusion About the Term "Technology"

There is much confusion today by the general public about the term "technology." One only has to read a newspaper or watch a television program to realize that technology has many meanings . Technology is often confused with terms such as science. In 2001 and 2004, the International Technology Education Association (ITEA), in conjunction with the Gallup Organization of Princeton, New Jersey, conducted polls on How Americans Think About Technology. In the 2001 survey, 1,000 telephone interviews were conducted of a national, general population sample of adult men and women, ages 18 and over. In the 2004 survey, the sample size was 800. The results from these two surveys are:

- In both polls, a majority of Americans (62% in 2004, 59% in 2001) responded that science and technology are basically one and the same thing.

- When asked in the 2001 poll how important it was for high school students to understand the relationship between science and technology, 98% stated that it was very or somewhat important.
- Most Americans (68% in 2004, 67% in 2001) view technology narrowly as being computers, electronics, and the Internet. This was the result of an open-ended question that was provided to the respondents in which they had to verbally tell the interviewer what they thought technology was.
- There was near total consensus in both polls (98% in 2004, 97% in 2001) of the public sampled that schools should include the study of technology in their curriculum.

## 3. Clarifying the Difference in Technology and Science

It has been documented that there is mass confusion about what science and technology are in the United States. If this is true, then what is the best thinking of our time as to what science and technology are?

Science, which deals with and seeks the understanding of the natural world (NRC, 1996, p. 24), is the underpinning of technology. Rodger Bybee, President of the Biological Sciences Curriculum Study (BSCS), explains more about science and technology.

> A lack of technological literacy is compounded by one prevalent misconception. When asked to define technology, most individuals reply with an archaic and most erroneous idea that technology is applied science. Although this definition of technology has a long standing in this country, it is well past time to establish a new understanding about technology. It is the interest of science, science education, and society to help students and all citizens develop a greater understanding and appreciation for some of the fundamental concepts and processes of technology and engineering. (2000, pp. 23–24)

Science is very concerned with <u>what is</u> (exists) in the natural world. Many of the courses in schools, colleges, and universities reflect this natural world inquiry. These courses deal with biology, chemistry, astronomy, geology, etc. Some of the processes that are used in science to seek out the meaning of the natural world are “inquiry,” “discovering what is,” “exploring,” and using “the scientific method.”

Technology, on the other hand, is concerned with <u>what can or should be</u> through the modification of the natural world to meet human wants and needs (ITEA, 2000, p. 7). This definition is comparable with the definition provided in the *National Science Education Standards* which states, “The goal of technology is to make modifications in the world to meet human needs” (NRC, 1996, p. 24). Similar to these definitions, the American Association for the Advancement of Science (AAAS) *Benchmarks for Science Literacy* presents the following: “In the broadest sense, technology extends our abilities to change the world; to cut, shape, or put together materials; to move things from one place to the other; to reach further with our hands, voices, and senses” (1993, p. 41). In the National Academy

of Engineering (NAE) and the National Research Council (NRC) publication, *Technically Speaking*, technology is described as "…the process by which humans modify nature to meet their needs and wants" (2002, p. 2). All of these nationally recognized definitions of technology in the United States are very similar and reinforce each other. Technology is very concerned with what can and should be designed, made, and developed from the natural world materials and substances to satisfy human needs and wants. Some processes used in technology to alter and change the natural world are "invention," "innovation," "practical problem solving," and "design."

In the United States, there is a growing movement that involves the development of educational programs that center around science, technology, engineering, and mathematics (STEM). Many of the programs being proposed at the national level include the combined study of STEM across disciplines and grade levels. While technology and science have a common denominator being the natural world, they are similar, yet very different. Technology is no more applied science than science is applied technology.

## 4. Technological Literacy

The term "technological literacy" refers to one's ability to use, manage, evaluate, and understand technology (ITEA, 2000/2002/2007). In order to be technologically literate, a person should understand what technology is, how it works, how it shapes society and in turn how society shapes it. Moreover, a technologically literate person has some abilities to "do" technology that enables them to use their inventiveness to design and build things and to solve practical problems that are technological in nature. A characteristic of a technologically literate person is that they are comfortable with and objective about the use of technology neither scared of it nor infatuated with it. Technological literacy is much more that just knowledge about computers and their application. It involves a vision where each person has a degree of knowledge about the nature, behavior, power and consequences of technology from a real world perspective.

So who should be technologically literate today and in the future? Since we live in a world that is influenced by and controlled with technology, everyone should have a level of technological literacy. How can one become technologically literate? The best way is to have every student in grades K-12 in schools today to undertake a study of technology by taking technology education and other subjects which teach about technology.

**What Content Should be Taught in the Study of Technology?**

The in-depth content for what every student should know and be able to do is documented in the International Technology Education Association's (ITEA) *Standards for Technological Literacy (STL)*. A belief presented in *STL* is that all citizens in the future can and should become technologically literate.

Standards for technological literacy have been developed by the International Technology Education Association (ITEA). These include *Standards for Technological Literacy* (*STL*) (2000/2002/2007), which provides the content for what every student should know and be able to do in order to be technologically literate. *Advancing Excellence in Technological Literacy* (*AETL*) (2003) has three sets of standards within its organization. They address (1) student assessment standards, (2) professional development of teachers of technology standards, and (3) technology program standards.

Technology education is a school subject specifically designed to help students develop technological literacy. Technology education is not the same as educational technology. Sometimes educational technology is referred to as instructional technology. It involves the study of computers and the use of technological developments, such as computers, audio visual equipment, and media as tools to enhance and optimize the teaching and learning process and the environment in all school subjects.

The vision of *STL* is that all students can and should become technologically literate. So what is technological literacy? ITEA defines it as one's ability to use, manage, evaluate, and understand technology. Technological literacy is more of a capacity to understand the broader technological world rather than an ability to work with specific pieces of it (NAE & NRC, 2002, p. 22). STL has been translated into the Japanese, Chinese, German, Finnish, and Estonian languages.

Some of the characteristics of *STL* are:

- There are five categories of organizational headings under which 20 standards are provided.
- *STL* uses the idea of standards from the *National Science Education Standards* and the idea of benchmarks from the Project 2061 *Benchmarks for Science Literacy* and combines them into a presentation of technological literacy.
- Under the 20 standards, there are approximately 290 benchmarks that provide further elaboration and detail to each of the standards. They are organized by grade cluster (K–2, 3–5, 6–8, and 9–12).

The major categories in *STL* are:

* The Nature of Technology
- Technology and Society
- Design
- Abilities for a Technological World

- The Designed World

Under each of the five categories there are 20 major standards. They are as follows:

The Nature of Technology

Standard 1: Students will develop an understanding of the characteristics and scope of technology.

Standard 2: Students will develop an understanding of the core concepts of technology.

Standard 3: Students will develop an understanding of the relationships among technologies and the connections between technology and other fields of study.

Technology and Society

Standard 4: Students will develop an understanding of the cultural, social, economic, and political effects of technology.

Standard 5: Students will develop an understanding of the effects of technology on the environment.

Standard 6: Students will develop an understanding of the role of society in the development and use of technology.

Standard 7: Students will develop an understanding of the influence of technology on history.

Design

Standard 8: Students will develop an understanding of the attributes of design.

Standard 9: Students will develop an understanding of engineering design.

Standard 10: Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.

Abilities for a Technological World

Standard 11: Students will develop the abilities to apply the design process.

Standard 12: Students will develop the abilities to use and maintain technological products and systems.

Standard 13: Students will develop the abilities to assess the impact of products and systems.

The Designed World

Standard 14: Students will develop an understanding of and be able to select and use medical technologies.

Standard 15: Students will develop an understanding of and be able to select and use agricultural and related biotechnologies.

Standard 16: Students will develop an understanding of and be able to select and use energy and power technologies.

Standard 17: Students will develop an understanding of and be able to select and use information and communication technologies.

Standard 18: Students will develop an understanding of and be able to select and use transportation technologies.

Standard 19: Students will develop an understanding of and be able to select and use manufacturing technologies.

Standard 20: Students will develop an understanding of and be able to select and use construction technologies.

Benchmarks in *STL* provide the fundamental content elements for the broadly stated standards. Benchmarks, which are statements that provide knowledge and abilities that enable students to meet a given standard, are provided for each of the 20 standards at the K–2, 3–5, 6–8, and 9–12 grade levels. They provide further elaboration and detail to the standards. A sample standard and benchmark is as follows:

Standard 11: Students will develop the abilities to apply the design process.

A Sample Grade K–2 Benchmark in Standard 11:

*Build or construct an object using the design process.*

**5. Summary**

The power and promise of technology can be further enhanced through the study of technology in Technology Education to assure that all people are technologically literate in the future. Anything short of this will jeopardize a country's ability to be competitive in the world marketplace and to solve human and other problems through the wise use of technology.

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**URL of Interest:**

STL - International Technology Education Association (ITEA): <www.iteaconnect.org>