

# Criteria for Evaluating Use of Information Technology

By THEODORE W. FRICK, Ph.D.

- ▶ [Editors Podium](#)
- ▶ [Distance Education and the Social Covenant](#)
- ▶ [English as a Vehicle of a More Open Society in Uzbekistan](#)
- ▶ [Accrediting Bodies Consider New Standards](#)
- ▶ [Criteria for Evaluating Use of Information Technology](#)
- ▶ [The Writings of Guy Bensusan](#)
- ▶ [Year 2000: Editorial Calendar](#)
- ▶ [For Our Readers and Subscribers](#)
- ▶ [Call For Papers](#)
- ▶ [Table of Contents](#)
- ▶ [Archive of Past Issues](#)
- ▶ [Download the printable Acrobat PDF version](#)

Editors Note: Dr. Frick's understanding of the technology/education milieu is based on rock solid experience and expertise. This is a formidable period of change for education. In this article, Dr. Frick's excellent research provides clear and welcome direction in the K-12 area. We educators need all the help we can get.

## Criteria for Evaluating Use of Information Technology in K-12 Education

### Overview

This document addresses the topic: evaluation of use of information technology in education. First, I will discuss the use of information technology as a lever for change in educational systems and practice. Second, I will talk about the development of criteria for evaluating information technology systems in K-12 education. During 1993-95, I played a central role on a team of faculty and graduate students at Indiana University who helped develop these criteria for the National Study of School Evaluation. I will provide a brief overview of the criteria for use of information technology in K-12 education in the United States. Finally, I will share my personal philosophy on use of technology in education.

### Stability and Change in Education

The publication of A Nation at Risk in 1983 helped to renew U.S. efforts to further improve public schooling. We have given names to these reform efforts such as: site-based management, school restructuring and educational systems design (cf. Banathy, 1991; Reigeluth, 1992; Frick, 1993).

One difficulty in changing a system is that it tends to remain the same. Systems try to attain and maintain some level of stability (cf. Maccia & Maccia, 1975; 1966). The big challenge is: How can we overcome this stability in our education systems in order to make positive changes, without harming what is already good and should not be changed? One educator in Indiana has joked that the problem of getting our schools to change is like trying to change the direction of a big elephant going 100 miles per hour.

### The Concept of Leverage in Systems

Larry Hutchins (1996) argues that "complex systems are changed by altering feedback and decision-making at critical leverage points." (p. 129) Peter Senge (1990) likewise claims that "... systems thinking also

shows that small, well-focused actions can sometimes produce significant, enduring improvements, if they're in the right place." (pp. 63-64)

Buckminster Fuller used the metaphor of the trim tab, which is a 'rudder on the rudder' of a ship. The 'trim tab' on the rudder of a boat illustrates the concept of leverage. To turn a massive oil tanker, for instance, requires a huge amount of force because it weighs thousands of tons and has a very large momentum. If we use a simple invention, called a trim tab,' we can turn the ship with relatively little force and effort. The trim tab gives us leverage, in a way that is similar to using a lever and fulcrum to lift a heavy object.

Is there a way to exert leverage to improve our current system of education? I believe so, and that was what motivated me to become involved in a project with the National Study of School Evaluation beginning in 1993. Before telling you the beginning of this story, let me tell you the result of this project.

### **Indicators of Quality Information Technology Systems in Education**

The National Study of School Evaluation recently published *Technology: Indicators of Quality Information Technology Systems in K-12 Schools* (NSSE, 1996). This publication provides:

a vision for student learning in technology through suggestions of performance indicators at the elementary, middle and high school levels, indicators for judging how a school's instructional system supports learning achievement in technology, and indicators for evaluating how a school's organizational system supports its vision.

Schools across the U.S. are expected to use these principles and indicators as part of their self-assessment for accreditation. I believe that these principles and indicators could serve as a 'trim tab' or lever' which could ultimately change K-12 educational practice. Let me explain how that might be so by briefly describing some key relationships in the structure of the current K-12 education system.

U.S. public schools are reviewed about every five years for purposes of accreditation. Prior to a site visit by a regional accreditation team, schools use materials created by the NSSE. These materials help schools -- in advance -- to conduct a self-evaluation according to the criteria listed within. The reports they create are an important source of information that affects their accreditation status. A school that is not accredited is unable to receive many of the funds from state and federal education budgets. Most schools try hard to remain accredited, because it is difficult to recover from this lack of funding.

### **Overview of the Goals, Principles and Indicators for Evaluation of Use of Technology in Education**

*Technology: Indicators of Quality Information Technology Systems in*

K-12 Schools, has been available to schools since March, 1996. In the preface, Edward W. Bales, Director of Education-External Systems, Motorola University states:

The 'world of work' is changing at a dramatic pace on a global basis... The standards developed by the National Study of School Evaluation (NSSE) will help school systems to develop curriculum, instruction and assessment methods which will prepare young people for this new global workplace... These Indicators of Quality Information Technology Systems do truly reflect commonplace requirements for the world of work. I commend NSSE for their work in developing these standards and support their implementation." (p. xi)

**The NSSE takes strong position about  
the importance of information technology:**

Information technology should be considered the 'fourth R' in today's educational system. After reading, writing and arithmetic, the use of information technology is the "reality" that faces students upon graduation and is often a barrier to entry into the work force. Only after schools begin to develop high quality information technology systems, with the goal of creating a technologically literate graduate, will students be prepared to meet the challenges and expectations of the information-age society. (NSSE, p. 5)

In the vision, they identify four major goal areas:

Information technology basics

Application and integration of technology

Creativity tools

Information technology in life and society

Most importantly, the vision provides performance indicators for student accomplishments by the fourth, eighth and twelfth grades. For example, fourth graders should be able to do word processing tasks such as highlight, cut and paste, search and replace, etc. Eighth graders should be able to create multimedia presentations and reports, use e-mail regularly for communication with teachers, classmates and friends, and be able to access on-line information for class work and personal interest. Advanced twelfth grade students should be able to set up computer networks, and to install and remove internal components of a computer.

The vision suggests performance indicators (successful actions or behaviors) to help educators measure student accomplishments in information technology. Examples illustrate how to conduct these performance assessments.

Individual school systems should, however, develop their own vision. The NSSE vision is provided to stimulate and perhaps to provoke educators' thinking and planning.

In addition, the document provides criteria for a school's instructional and

organizational systems that support achievement of student learning goals. It gives principles and indicators of a school's instructional system for:

- curriculum development, instructional design, and assessment systems;
- and of a school's organizational system for:
- leadership, professional development, policies, resources, and the development of a community of learners.

Samples of the goals, principles and indicators are listed in the appendix.

### **The NSSE Project: How the Criteria Were Created**

Many states in the U.S. now require a technology plan and/or technology curriculum to be in place in schools. Normally, they would turn to NSSE guidelines for evaluating their plans. Prior to 1996, however, the NSSE had not made available any guidelines in this area. In 1993, the NSSE asked several faculty in the Department of Instructional Systems Technology (IST) at Indiana University to begin creating guidelines.

Professor James Pershing at Indiana University directed our team of IST faculty and graduate students. We decided that a systemic approach would be used to develop these guidelines in order for schools to better determine the best way to integrate technology (NSSE, 1994; Frick, 1991; 1993).

Our team drew on its own considerable collective experience with information technology in education over the last three decades. We also reviewed research on the successful use of information technology. We then conducted focus groups in Michigan, Texas and Indiana with K-12 teachers, administrators and technology coordinators. In the focus groups, we asked educators to respond to five questions:

1. When someone mentions 'Information Technology,' what does it mean to you?
2. What are the major forces that are influencing adoption of technology?
3. What are the major issues and barriers to implementation of technology in education?
4. When someone mentions 'technology standards for school accreditation,' what does it mean to you?
  - a. What would be appropriate criteria to use in evaluating schools in relation to technology? (Also think about possible pitfalls.)
5. Who should be responsible for managing technology resources? (teacher, administrator, media personnel, \_\_\_\_\_ ?)

We took extensive notes as we listened to these educators tell us what was on their minds. We later were able to identify common patterns and themes which served as the foundation for the eventual criteria. National experts in educational technology reviewed initial drafts of the guidelines. Public school teachers, computer coordinators, and school administrators also gave us feedback. We then conducted usability tests of later drafts

with school personnel who would be likely to use these guidelines for self-evaluation. In late 1995, we submitted the revised guidelines to the NSSE Board of Directors, which is headed by Dr. Kathleen Fitzpatrick. She directed the final phases of this project, and the NSSE used our input to draft the final version.

While the NSSE is the author of this publication, I am most proud of my contributions of 1) the vision, and 2) the samples of performance assessments for student achievement in technology. These were largely retained in the final document.

### **My Personal Philosophy Regarding Use of Technology in Education**

I have worked with computer technology in education for over 25 years. I have taught thousands of college students in the last 14 years to use computers in education, to design and develop computer-mediated learning products, and to evaluate them as well. My philosophy is centered around four important ideas:

1. Technology is a means, not an end in education.
2. Technology is best used in education for teaching and learning activities that are not possible without it.
3. Teachers should select the best of culture, and make it available to students as they guide their learning.
4. The best way to predict the future of education is to make it.

### **Technology is a means, not an end.**

Schools currently seem to be in a mad rush to adopt computers and other information technology. They are facing increased pressure from parents, students and business leaders to do so. I believe that this information technology revolution that we are now experiencing will eventually lead to transformation of our present educational systems (Frick, 1991).

However, we should not view computer technology as an end in itself. Technology is a means to an end, like a book of matches is a means to create fire, or like a bicycle is a means of transportation.

The end we should keep in mind for education is to improve the quality of life (Maccia & Maccia, 1975). The primary purpose of education should be: make everyone's life better, not worse. We hope that by educating our younger generations, they will not repeat mistakes that past generations have made through ignorance or lack of experience.

*In education, what can we do with technology that we could not do without it?*

When I was conducting one of the NSSE focus groups, I remember clearly when a computer coordinator suggested this criterion. I was immediately struck with her wisdom: What can we do with information technology that could not be done without it to help students learn? This turns out to be a very useful and powerful criterion.

For example, SimCity is a computer simulation that allows you to build a city and observe the consequences of how you zone the land (commercial, industrial, residential), where you put roads and utilities, etc. Your city may thrive and grow. Or it may drive away business and residents because of traffic problems, crime, high taxes, and expensive housing. You can repeat the simulation many times, and see what happens when you try different designs for your city. This is a powerful learning tool. I cannot think of any practical way that a student could learn these city planning principles in a short period of time -- compared to a lifetime of experience. When my 75-year old father came and visited several years ago, he had never used computers before. I showed him how to use SimCity. On his own, he then later spent hours experimenting with and learning from this computer program.

During a recent visit, I showed my father some of my work on the World Wide Web (the design of the Indiana University Bloomington site). Then I showed him a search engine (AltaVista), and asked him what he would like to find. He wondered how many people we could find named Frick'. We did the search and found hundreds of Web documents that contained our family name. I cannot think of any other practical way that we could do this so easily, quickly and cheaply.

When I was preparing for an international conference in Taiwan, I had many e-mail exchanges with Professor Nay-Ching (Nancy) Tyan. We were separated by thousands of miles: I was in Bloomington, Indiana in the U.S. and she was in Taipei. I sent her earlier drafts of my presentation as e-mail attachments. She did not know at first how to view an attachment when it is a word-processed document. So I used e-mail to teach her how to save the attachment and transfer the binary file to her desktop computer. Then she could open the document with her word processor and print it. We could do this communication faster, more effectively, and more conveniently by e-mail -- even though separated by thousands of kilometers and many time zones -- than she could to find a local computer consultant to assist her. Again, I cannot think of any other practical, inexpensive way that this much communication could go on between us under these circumstances of being separated by such time and distance.

My wife, Kathy, is a Montessori teacher of young children, ages 3 to 6 years. As you may know, Montessori learning materials and methods have been available for nearly a century, and consist of many simple, cost-effective instructional technologies which existed long before computers were invented. For example, when students build the pink tower or do the graduated cylinder work, they learn mathematical concepts of volume and cardinal order. Kathy does not use computers for these kinds of learning activities which are done much more cost-effectively with simpler instructional technology (wooden objects). However, she does use computers for students to learn elementary programming concepts with Logo, or to do music composition. These learning activities would be difficult and impractical without a computer to mediate them.

**Teachers should select the best of culture and act as guides.**

This ought to be the primary role of teachers. Information technology itself cannot select the best of our culture for sharing with students. The technology is incapable of doing that. It cannot tell right from wrong. It cannot distinguish opinion from truth. It cannot appreciate beauty. In short, the new technology cannot evaluate the worth of the content that is embodied in the medium. That is our essential role as teachers.

In my 1991 publication, *Restructuring Education Through Technology*, I suggested ways that information technology can make possible new kinds of teacher-student, student-content, and student-context relationships. If teachers can select and carefully organize a critical mass of student learning materials and activities in the classroom which are perceived as meaningful, motivating and useful to students, then we can give up the role of teacher as "sage on the stage" and become "guides on the side." Actually, this is not a new idea. Montessori classrooms have worked this way for about 90 years.

Teaching has been historically viewed as "sage on the stage." In particular, prior to the invention of the printing press about 500 years ago, this was often a necessity. A teacher was the primary resource for knowledge and made that knowledge available to students through lectures and demonstrations. Nowadays knowledge can be made available through print, video and computer media. A teacher no longer needs to be front and center. "Guide on the side" describes the role that modern teachers can take. Teachers can select print and electronic media, through which other teachers can convey their messages. This does not mean that the role of the teacher is diminished. In fact, the opposite is true. Teachers and students are empowered by these additional learning resources. However, the emphasis can be changed. There can be less "sage on the stage" and more "guide on the side."

### **Making the future.**

The printing press and more recently television have brought about widespread change on an international level. We are aware now, more than ever, what is going on in other parts of the globe. Through the Internet and the World Wide Web, we are now experiencing a transformation in communication that is unrivaled in the history of civilization as we know it.

I don't know how things will turn out. Hopefully, humankind won't blow the world to smithereens with nuclear weapons. Hopefully, humankind won't exhaust our natural resources and destroy our ecosystem with overpopulation.

Alan Kay, who helped design the graphical computer interface at Xerox PARC in 1970s that was later adapted for the Apple Macintosh, has said many times: "The best way to predict the future is to make it." As educators, the future is in our hands, and we have some powerful tools to help create it.

### **References**

- Banathy, B. (1991). Systems design of education. Englewood Cliffs, NJ: Educational Technology Publications.
- Frick, T. (1991). Restructuring education through technology. Bloomington, IN: Phi Delta Kappa Educational Foundation.
- Frick, T. (1993). A systems view of restructuring education. In Reigeluth, C., Banathy, B. & Olson, J., Comprehensive systems design: A new educational technology. Berlin: Springer-Verlag, 260-271.
- Hutchins, C. (1996). Systemic thinking: Solving complex problems. Aurora, CO: Professional Development Systems.
- Maccia, E. and Maccia G. (1966). Development of educational theory derived from three theory models. Washington, DC: U.S. Office of Education, project No. 5-0638. See also the World Wide Web, at URL: <http://education.indiana.edu/~frick/siggs.html>
- Maccia, G. & Maccia, E. (1975). SIGGS theory as a systems theory for education which enhances the quality of life. In Systems thinking and the quality of life: Proceedings of the annual North American meeting (The Society for General Systems Research), p. 228-233.
- National Commission on Excellence in Education (1983). A nation at risk. Washington, DC: U.S. Governmental Printing Office.
- National Study of School Evaluation (1994). NSSE evaluative criteria for information technology in K-12 schools. (Final Report, Project directed by J. Pershing). Schaumburg, IL: Author.
- National Study of School Evaluation (1996). Technology: Indicators of quality information technology systems in K-12 schools. (Project directed by K. Fitzpatrick and J. Pershing). Schaumburg, IL: Author. Copies may be obtained by calling the U.S. at (847) 995-9080, fax to (847) 995 - 9088, or mail inquiries to: The National Study of School Evaluation, 1699 East Woodfield Road, Suite 406, Schaumburg, IL 60173, USA.
- Reigeluth, C. (1992). The imperative for systemic change. Educational Technology, 32(11), 9-12.
- Senge, P. (1990). The fifth discipline: The art and practice of the learning organization. New York: Doubleday/Currency.
- Shaw, R. (Fall 1993). A backward glance: To a time before there was accreditation. NCA-Quarterly, 68 (2), 323-335.

---

#### About The Author:

Dr. Theodore W. Frick is an Associate Professor and the Web Director, in the School of Education, Indiana University, Bloomington. He currently teaches graduate courses on computer-mediated learning, Web design, and inquiry methods, He is interested in improving education and schooling in general through the design of computer-mediated products, research on interaction design, usability engineering, and educational research methodologies. For further information see: <http://education.indiana.edu/~frick>. Dr. Frick has suggested that our readers might want occasionally to check: <http://education.indiana.edu/nsse.html>. He will up date the research

presented above. His new findings will be posted there. Dr. Frick may be reached at: [frick@indiana.edu](mailto:frick@indiana.edu), Department of Instructional Systems Technology School of Education Indiana University Bloomington.

---

[Contents](#)

[Editors  
Podium](#)

[Top  
Stories](#)

[Calendar](#)

[For Our  
Readers](#)

[Call For  
Papers](#)