DOCUMENT RESUME

ED 339 365 IR 015 328

AUTHOR Pedras, Melvin J.; Braukmann, Jim
TITLE Technology Education for Elementary School Teachers.
PUB DATE 91
NOTE 13p.; Paper presented at the Annual Conference of Partnerships in Education (Lewiston, ID, October 3-4, 1991). For a related paper, see IR 015 327.
PUB TYPE Information Analyses (070) -- Viewpoints (Opinion/Position Papers, Essays, etc.) (120) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Class Activities; Elementary Education; Elementary School Curriculum; *Elementary School Teachers; Microcomputers; Problem Solving; *Teacher Role; *Technological Literacy

ABSTRACT

The changing nature of educational technology in our society provides elementary school teachers and other educators with numerous challenges and problems for the elementary school curriculum. One such challenge is to teach students how to solve problems and utilize the general education they acquire to arrive at realistic solutions. Elementary students must be taught to make informed decisions about technology, its uses, and its impact on society. To that end, many classroom teachers are beginning to include hands-on class activities utilizing microcomputers to reinforce problem solving skills. It is particularly important that elementary students become technologically literate so that they may advance in the society of the 21st century. (21 references) (DB)

TECHNOLOGY EDUCATION FOR ELEMENTARY SCHOOL TEACHERS

Paper Presented at the
Partnerships in Education Annual Conference
October 3-4, 1991

Lewiston, Idaho

Dr. Melvin J. Pedras
Associate Professor of Education
Division of Teacher Education
University of Idaho
Moscow, Idaho

Dr. Jim Braukmann
Associate Professor & Chairman
Department of Technology
EasternWashington University
Cheney, Washington

TECHNOLOGY EDUCATION FOR ELEMENTARY SCHOOL TEACHERS

INTRODUCTION

The advancement of technology into almost every aspect of our lives has left us with an almost overwhelming responsibility in preparing our students to live and cope with change. Leaders in technology tell us that the body of knowledge we are responsible for is doubling every five years, some even say it is less.

Our traditional teaching methods and facilities have left us ill prepared to deal with such a rapidly changing phenomenon. We, in education, have traditionally been the slowest to react to change, but now we are faced with the responsibility of educating students about the fastest changing aspect of our society, i.e. technology.

Today's elementary school students will live in a society that demands an understanding of technology. As we move toward the next century, technological literacy will become increasingly important to all citizens. This is further reinforced by the National Science Foundation report, Educating Americans for the 21st Century (1983), which indicates that technological literacy is a basic capability that all people need to possess. It is necessary, therefore, to begin preparing children for the responsibilities of citizenship in a technological society as soon as possible, i.e. at the elementary school level.

For the purposes of this papar, **technology is defined as a body of knowledge and application of resources to produce results in response to human needs and wants.** Technological literacy, therefore, is the possession of a reasonable understanding of technical means used for survival, and its context within our society. Therefore, the central goal of technology education in our public schools must be to provide young people with technological literacy so they may join our technological society as productive and happy citizens (Daiber, Litherland, Thode, 1991). Maley (1987) reinforces this by identifying five functions citizens perform which are dependent upon technological literacy:

*a user of a vast array of technology,
*a decision maker - both personal and as a citizen regarding technology,
*a purchaser and consumer of a wide variety of technology,
*a key element in the further use and development of technology,
*a worker and wage earner in an increasingly technological workplace. (p. 46)

Technology has impacted upon all of human life for many thousands of years, but only recently has it caused more remarkable changes to occur than ever before in history. We now are completely enveloped by technological systems. We have become dependent upon the products and services which technology provides. All industries and all people will continue to be greatly affected by new technological developments.

The impact of technology on our industrial society is visible everywhere. The electronics industry for example, uses new and better integrated circuit design to produce enhanced computers and computer controlled products. Cameras use a microcomputer to help it focus properly or to select the correct shutter speed. Automated bank teller machines continue to operate after closing hours and FAX and computer networks communicate on a daily basis (Hacker and Barden, 1988). Robots are increasingly used by manufacturers to streamline assembly line chores such as drilling, welding and painting. Computer-aided drafting has increased the productivity of drafters as they prepare architectural and engineering drawings. It produces better quality drawings, facilitates drawing modification and allows for drawing manipulation and product analysis (Wright, 1990). Supersonic travel, ushered in by the development of the Soviet TU -144 aircraft, and further advanced by the European built Concorde and the U.S. built SST has the potential of greatly changing common air transportation (De Old, Sheets and Alexander, 1986).

It is imperative, as can be seen above, that students become educated about the technological society which is, and will continue to impact their lives. They must be taught how to live and manage technology without becoming enslaved by it (Pedras and Braukmann, 1990). According to Daiber, Literland & Thode (1991) the time to start teaching students about technology is at the elementary level. Students at this level have an innate curiosity about their surroundings and most often they are virtually fearless when it comes to trying out new ideas and technologies.

Perspective and Background on Technology Education

The history of technology parallels the development of humankind and certainly was an important catalyst in the development of our country over the past one hundred years. Without technological developments our society would likely be no further advanced than other cultures who preceded us. Many, including the Egyptians, Babylonians, Greeks, and Romans, rose to varying levels of achievement in government, economics, medicine, education, and the rudiments of technology were then unilaterally overtaken, or replaced. The difference, in our short history, is that we discovered how to use readily available materials such as petroleum, steel, glass, and rubber to create a family of technologies which have rapidly led to the highest achievements in medicine, education, industry, and business ever known on the earth.

Our recent evolution in advanced technological development is crucially important to our future and is now being recognized as the nucleus of an important new curriculum component for all school age students. Ten years ago the only generic technology subjects offered in schools were industrial arts or vocational education. Those areas were within the exclusive domain of teachers prepared specifically to teach in those disciplines. Within the past few years the concept of technology has changed dramatically and it is now being taught by increasing numbers of teachers from all levels (K-12 and beyond) who integrate many forms of technology into their curriculum (Brusic, Dunlap, Dugger and LaPorte, 1988; Kieft, 1988: Thode, 1989: Barnes, Wiatt and Bowen, 1990 and Bagshaw, 1990).

Until recently the "shop" teacher took care of any technology experience students received in our nations schools. Students either enrolled in industrial arts, vocational education or cooperative work experience. Today, students who wish to pursue a vocational career enroll in agriculture, business education, marketing education, trades and industry education, home economics education, etc. Those who formerly enrolled in industrial arts shop classes, however, are finding a new curriculum called technology education. This new exploratory curriculum focuses on technology clusters, including: construction, manufacturing, communication, transportation, and bio-related technologies. These new offerings are specifically geared to a broad focus of "technology" and are typically taught in elementary, middle school, junior high, and

secondary levels. They provide a much needed emphasis on technology and begin the goal of making all students technologically literate.

Although discreet technology courses have a definite place in the school curriculum, they accomplish only part of the goal to provide all students with the technology skills necessary for survival in the the 1990's and beyond. This is where every classroom teacher plays a very important role. Maley (1989) stated that "there must be someplace in the school where the student can put all the parts (academic disciplines) together in the context of reality and the world beyond the school. . . That Place is Technology Education." All teachers now have the challenge and opportunity to integrate and infuse technology concepts and skills into their curriculum. This is accomplished by working individually and with other teachers to integrate subject matter such as English, math, science, and music through kinesthetic (hands on) activities; designing new curriculum specifically with technology included; and by developing or adapting emerging curriculum programs such as Science, Technology, and Society (STS) and Principles of Technology (PT).

A Holistic Approach to Education

It is vital that all students understand and are able to use technology proficiently. The lack of this proficiency can be seen in those who own home entertainment centers but cannot program components such as a VCR, or in the consumer who is intimidated by the computer. Even more important is the holistic nature of education and the role that technology education has to offer.

Education must be concerned with the total development of the student. It must also be concerned with a balance between the intellectual and the practical phases of student experience (Dewey, 1900). Technology education provides a platform whereby all curriculum areas can be integrated and practical experiences shared (Maley, 1989). The opportunity to help students maximize their achievement potential and develop a sense of well being relies on the creativity of teachers.

Another equally important function of education is to provide individual development for enlightened citizenship in a democracy, a sense of contribution to society, and satisfied living in our technological society. The study of technology can provide students with positive learning experiences which

integrate all these areas. One example is the study of manufacturing technology where students organize a company to produce and market a product. In this exercise, students learn to work in a cooperative environment with their peers and become responsible for a part of the total product. They also learn that industry is a vital part of our society and insures numerous contributions to our way of life.

Technology education can also provide the "citizen" student with background and understanding vital to future involvement on local, state, and national levels. The curriculum content is essential in the present and future technological society as the individual learns to function in a variety of roles. These roles may involve the citizen as a voter; an office-holder; a participant in public interest committees; a member of political coalitions, appointed councils, or commissions, and as an advisor to government officials. These citizenship roles place a strong mandate on technological literacy, since many of the critical issues of the future will involve sophisticated perceptions and astute decisions related to technology (ITEA, 1988).

A final function of education that can be enhanced with the study of technology is the realization that students are a significant force in shaping the future course and direction for all humankind. Technology is in itself neutral. Its use can provide benefits for society or it can be used for self-destruction. It can be alternately seen as a major source of society's problems, or as the salvation of society (Braukmann and Pedras, 1990). Students can learn the intelligent use of technology and the consequences of its misuse through the study of technology education within a holistic framework.

EFFECTIVE TECHNOLOGY EDUCATION FOR THE ELEMENTARY SCHOOLS

Advanced technology has taken on a new and important role in our society. It has emerged to assume a place of importance in education, business and industry, medicine, space, etc. In the educational community technology educators describe their new curriculum as "technological literacy" and "the new basic". It is incumbent on all educators, however, to understand how to effectively and efficiently use this new tool to maximize learning for all students.

For elementary educators, this means providing the proper learning experiences that integrate technology, into the classroom. Students must learn from technology about technology, and with technology whenever appropriate (Daiber, Litherland & Thode, 1991).

Research indicates that rote memorization learning yields approximately ten percent retention by most learners (Jeldon, 1974), not good by anyone's standards. That figure can be increased dramatically by introducing a kinesthetic (hands on) approach augmented with technology. For example, mathematics comes to life when a computer is used to demonstrate practical problems using proven software programs. Physics takes on new meaning and motivation when the Principles of Technology (PT) program is used to encourage students to manipulate and experiment with science. Elementary students learn to communicate efficiently and effectively by composing on the word processor to write reports, stories, poems, homework assignments and letters. Students gain a new appreciation for social studies by collaboratively designing and reporting on social aspects of our society using computer generated materials and hands on construction of elements of American life such as early community design and construction (Pedras & Oaks, 1990).

PROBLEM SOLVING AND THE ELEMENTARY SCHOOL CURRICULUM

The ever changing nature of technology in our society provides educators with a myriad of challenges and problems for the curriculum. One such challenge is to teach students how to solve problems and utilize the general education they acquire to arrive at realistic solutions (Braukmann and Pedras, 1989). Elementary students must be taught to make informed decisions about technology, its uses and its impact upon society.

While curriculum guides and course outlines identify problem solving as a teaching technique, relatively few teachers know how to use it. Moreover, teachers have been deterred somewhat from using problem solving as a general instructional technique because the areas of investigation have tended to focus on users of mathematics, business management professionals, nurse educators, architects, engineers, philosophers, and psychologists (Waetjen, 1989).

Problem solving can be used as a highly effective teaching method especially when technology is used as a catalyst. For example there are computer programs currently available which include hands on problem solving activities for all levels of education from science to music. Students use the computer to set up the problem and describe how the research or discovery plan will function. They can proceed to graphically depict various elements of the problem using computer graphics.

Many classroom teachers are currently beginning to include hands on technology activities which further reinforces the problem solving method. Students may form small task forces, work as a large group, or work individually to consummate the problem solving activity by building and testing ideas and concepts. New activities designed specifically for classrooms without sophisticated equipment or materials may include a bridge-building activity where students learn mathematics, science, and technology by building small replica bridges in teams, using readily available materials such as tooth picks or popsicle sticks and fast drying glue. Each structure is built and tested to destruction to determine which team's bridge was strongest and why. A paper tower project challenges students to design and build the tallest free standing structure using a single sheet of paper as the only raw material. A similar activity involves using a sheet of paper and plastic straws to design and build a paper car which can be tested for aerodynamics, friction, etc., by racing in a timed series of runs down an inclined plane. Science, math, and design principles can also be studied in detail using this type activity. The computer could also be utilized with such programs as Car Builder (1985) or The Factory (1983) giving students an opportunity to learn about computer-aided design (CAD) and computer-aided manufacturing (CAM).

A powerful method for combining technology and subject matter is for teachers from a related discipline such as science and technology to team up and offer common learning activities. This method capitalizes on the strength of two or more teachers and clearly demonstrates to students the relationship between theoretical subject matter and practical applications.

Elementary or junior high teachers could combine social studies, English, and technology to study, and subsequently *build*, an African village. Students could team up in small groups to build separate components of the village. English class activities would include preparation of a written report (using the computer for graphics and written narration) and the composition of a

newspaper article written and edited by students for the school or community paper. The school's technology education teacher could assist students in the selection and processing of authentic materials, using a simple computer-aided design system to graphically represent the village and depict construction methods. Math could be incorporated to ensure each component of the village was scaled accurately in size and shape. Art instruction could be used to highlight the rendering of the completed village and would complement the construction activity.

The possibilities for cross curricular opportunities are virtually limitless. The payoff is excitement, motivation, and the meaningfulness of combining separate subjects and technology to create experiences never forgotten by students or teachers.

SUMMARY

Virtually all elements of human society are in some way touched by technology. It would be difficult to imagine a common household without some of the modern conveniences now employed in the electronic living room or all electric kitchen. Likewise in business and industry, the automated office and high tech assembly line are changing the workplace and the way work is performed.

Students who are not educated about the modern advances of our technological society will be ill-prepared for the world of work in the 21st. century. It is therefore incumbent upon all educators, especially elementary school educators, to modify traditional curriculum to reflect contemporary technology.

It is imperative that students become educated about the technological society that surrounds them. They must be taught how to live with and use technology as a resource without becoming constrained by it.

Education must be concerned with a balance between the intellectual and the applied phases of student experience. Technology education provides this balance and establishes a platform whereby all curriculum areas can be integrated together and commonalities explored.

Technology education, as a teaching strategy, can be used in a myriad of ways to enhance classroom teaching. It offers students the excitement of hands-

on learning and offers teachers the opportunity to integrate various areas of study and problem solving into the learning environment. It is the one educational setting where students can put all the parts together in the context of reality and the world beyond school.

BIBLIOGRAPHY

Bagshaw, H. (1990, March/April). Technology by design. Paper presented at the annual conference of the International Technology Education Association, Indianapolis, Indiana.

Barnes, J. L., Wiatt, C., & Bowen M. (1990) The NASA/elementary technology education project. The Technology Teacher, 49(4),13-17.

Braukmann, J. & Pedras, M. (1989, June). Problem solving in a technological society with implications for university teaching improvement. Paper presented at the 15th international conference on Improving University Teaching, University of British Columbia, Vancouver, Canada.

Braukmann, J. & Pedras, M. (1990). Preparing students for living in a technological society: a problem solving approach to teaching. Journal of Technology Education, 1(2), 19-25.

Brusic, S. A., Dunlap, D. D., Dugger, W. E., & LaPorte, J. E. (1988). Launching technology education into elementary classrooms. The Technology Teacher, 48(3), 23-25.

Daiber, R., Litherland, L., & Thode, T. (1991). Implementation of school-based technology education programs. In M. J. Dyrenfurth & M. R. Kozak (Eds.), Technology literacy (pp. 187-211). Peoria, IL: Macmillan/McGraw-Hill.

De Old, A. R., Sheets, E., & Alexander, W. (1986). Transportation. Worcester, MA: Davis.

Dewey, J. (1900). The school and society. Chicago: The University of Chicago Press.

Fish, M. & Kosel, M. (1983) The factory [Computer program]. Pleasantville, NY: Sunburst Communications.

Hacker, M. & Barden, R. A. (1988). Living with technology. Albany, NY: Delmar.

Hefter, R., Cunningham, D. & Worthington, S. (1985). Car builder [Computer program]. Norfolk, CT: Optimum Resources.

Jeldon, D. L. (1974) Development of instructional materials. Greeley:University of Northern Colorado.

Kieft, L. D. (1988). Your help is needed in elementary schools. The Technology Teacher, 48(2), 27-31.

Maley, D. (1987), Technological literacy: Roles for practical arts and vocational education. In Technological Literacy: The Roles of Practical Arts and Vocational Education, international symposium proceedings, May 13-15. Columbus, OH: The Ohio State University.

Maley, D. (1989, March). Technology Education: Why Do It? Paper presented at the annual conference of the International Technology Education Association, Dallas, Texas.

Pedras, M. & Braukmann, J. (1990). Technology education addressing new challenges. The Technology Teacher, 49(6), 29-32.

Pedras, M. & Oaks, M. (1990, October). Enhancing teaching with technology. Paper presented at the Partnerships in Education annual conference, Lewiston, Idaho.

Technology: a national imperative. (1988). Reston, VA: International Technology Education Association.

Thode, T. (1989). Technology education in the elementary school. The Technology Teacher, 49(1), 12-15.

Waetjen, W. B. (1989). Technological problem solving. Reston, VA. International Technology Education Association.

Wright, R. T. (1990). Manufacturing systems. South Holland, IL: Goodheart-Willcox.