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ABSTRACT

Students who are not educated in 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 to modify traditional curriculum to reflect contemporary technology. School technology education programs today are being developed to reflect the needs of our technological society. In the immediate past, teaching content for this field was derived from the traditional industrial trades and called industrial arts. Now, teaching content is derived from modern industry, encompasses a broad, holistic approach to education, and is called technology education. Technology education provides a balance between the intellectual and the applied phases of student experience 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 teachers the opportunity to integrate various areas of study and brings to the learning environment practical and realistic possibilities for student learning. (20 references) (CML)

ENHANCING TEACHING WITH TECHNOLOGY

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ENHANCING TEACHING WITH TECHNOLOGY

Introduction

Technology has impacted all of human life for many thousands of years, but only recently has it caused more remarkable change 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 uses new and better integrated circuit design to produce enhanced computers and computer controlled products. 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. Supersonic transport travel has become possible through advanced design in jet aircraft.

It is imperative, as can be seen above, that students become educated about the technological society they will be living in. They must be taught how to live and manage technology without becoming enslaved by it (Pedras and Braukmann, 1990).

Technology education programs currently in progress and those to follow are being driven at such an unpredictable pace of change that it is difficult to comprehend what the future will bring. Several years ago, we called our area of study industrial arts. It was characterized by drafting machines, wood lathes, and table saws. Construction of tool boxes, bird houses and book shelves were a mainstay of the field. Today, technology education is the appropriate name and computer aided drafting, computer aided manufacturing, laser photography and robotics is fundamental, and we spend more

time with silicon chips that we do with wood chip (Mordavsky, 1990).

We now teach a family of emerging new technologies including biotechnology, space technology, manufacturing technology, and communications technology to name a few. The industrial technology emphasis is still important but is not as strongly emphasized today since developing countries now produce an increasing share of our industrial and consumer goods including machine tools, cameras, watches, automobiles and clothing. This trend away from a strong industrial-manufacturing base has created the information age emphasizing advanced and emerging technologies that are now increasingly being emphasized in the school curriculum (Toffler, 1980).

Technology and Technology Education Defined

What is technology and what implications are there for education? Sanders (1991) indicated that technology denotes "doing." He also stresses that technology is more than computers and tools, and more than simply ideas. It is a synthesis of knowledge, tools and skills used to solve problems. Lauda (1988) further refines this definition and places it into an educational context as the study of the technical means used for survival, including the origin, nature of, structure and use of human contrivances in a societal context.

For the purpose of this paper the term technology education, especially as currently practiced by the profession, is defined as:

> A comprehensive, action-based educational program concerned with technical means, their evolution, utilization, and significance; with its organization, personnel systems, techniques, resources and products; and their sociocultural impact (AIAA, p.25).

These definitions serve a useful purpose in that they allow for mutual understanding. They have brought to the teaching p- .ession a new meaning to the teaching of what was once known as industrial

arts. Where in the immediate past teaching content for this field was derived from the traditional industrial trades it is now taken from modern industry and encompasses a broad, holistic approach to education.

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 then unilaterally were eventually overtaken, or simply faded away. 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 lead to the highest achievements in medicine, education, industry, and business ever known on the earth.

Our recent revolution 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 and those were 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, Bagshaw, 1990).

Until recently the "shop" teacher took care of any technology experience students received in our nation's schools. Students either

enrolled in industrial arts or vocational education. Students today 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.

Discreet technology courses have a definite place in the school curriculum, however, they accomplish only part of the goal to provide all students with the technology skills necessary for survival in 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. 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. 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 effective citizenship in a democracy, a sense of contribution to society, and effective living in our technological society. Technology study can provide students with positive learning experiences which integrate all these areas. An example is the study of construction 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 construction 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, for 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 technology study 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.

Technology as a Teaching Strategy

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 "the new basic". It is incumbent on all of us as educators to understand how to effectively and efficiently use this new tool to maximize learning for all students.

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. 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.

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 problem solve and utilize the general education they acquire to arrive at realistic solutions (Braukmann and Pedras, 1989).

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 an instructional technique because the areas of investigation have tended to focus on 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 popsicles sticks and fast dry 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 medium. 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 and computer aided manufacturing.

A powerful method for combining technology and subject matter is for teachers from a related discipline such as physics 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 (CAD) system to graphically represent the village and depict construction methods. Math could be used to accurately scale computations to ensure each component of the village was accurate to 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.

Technology education, as described in this section on strategies can be a most effective method of enhancing teaching. Further, it is a means to provide students with the best possible education for effective living and citizenship in an advanced technological society (Maley, 1989).

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 in 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 to modify traditional curriculum to reflect contemporary technology

It is imperative that students become educated about the technological society they will be living. They must be taught how to live with and use technology without becoming constrained by it.

School technology education programs today are being developed to reflect the needs of our technological society. Where, in the immediate past, teaching content for this field was derived from the traditional industrial trades and called industrial arts, it is now called technology education and is derived from modern industry encompassing a broad, holistic approach to education.

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 also offers teachers the opportunity to integrate various areas of study and brings to the learning environment practical and realistic possibilities for student learning. It is the one educational setting where students can put all the parts together in the context of reality and the world beyond school.

The possibilities for cross curricular opportunities are virtually limitless. The payoff is excitement, motivation, and meaningfulness of combining separate subjects and technology to create experiences not easily forgotten by students or teachers alike.

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