OTS Master's Level Projects & Papers   STEM Education & Professional Studies

1992

A Study to Determine Criteria Essential to Technology Education at the Secondary Education Level

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A STUDY TO DETERMINE

CRITERIA ESSENTIAL TO TECHNOLOGY EDUCATION

AT THE SECONDARY EDUCATION LEVEL

A RESEARCH PROJECT

PRESENTED TO

THE GRADUATE FACULTY

OLD DOMINION UNIVERSITY

IN PARTIAL FULFILLMENT

OF THE REQUIREMENTS FOR THE DEGREE

MASTER OF SCIENCE IN EDUCATION

By

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August, 1992

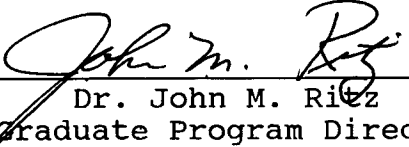This project was prepared by Jason Edward Perry under the direction of Dr. John M. Ritz in OTED 636, Problems in Education. It was submitted to the Graduate Program Director as partial fulfillment of the requirements for the Master of Science in Education degree.

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CHAPTER I

INTRODUCTION

The study of technology has played the important role of extending human intellect and creative potential in America's youth. Today, in many secondary schools, students are learning about the applications of technology. From computerized payrolls to Patriot missiles used in the Persian Gulf War, technology remains a dynamic, driving force of many societies and cultures, causing our public schools to "play catch-up" with other nations on the technological edge. As the future approaches, students within our educational system need to become technologically literate and able to understand and act upon changes within society and efficiently enter the work world.

Technology education, formally known as industrial arts education, is a field of study separate from science and mathematics courses. The transition to technology education from industrial arts has occurred in our educational system; however, many concerns and questions still remain as to the direction that it is taking at the secondary school level. Has technology education progressed to an acceptable level or has it adhered to its underpinnings of industrial arts, vocational, or technical education? To what degree have the programs effectively moved to accomplish the change to technology education in terms of the criteria established by

the accrediting agencies and by the consensus of experts consulted about this topic? In short, is the framework for preparing our children for the future established to reach technological literacy? The following research will develop and validate a list of evaluative criteria used to assess the effectiveness of change from secondary level industrial arts education to technology education.

Statement of the Problem

The problem of this study was to develop and validate evaluative curriculum criteria for assessing technology education programs. The final list of criteria may then be used to assess the effectiveness of program change from industrial arts education to technology education at the secondary education level.

Research Goals

To accomplish the purpose of this study, the following goals were used:

1. Determine the list of curriculum criteria essential to technology education programs at the secondary level.

2. Validate the list of curriculum criteria essential to technology education programs at the secondary level.

Background and Significance

During the National Governor's Association meeting in March 1990, state leaders had as a goal to make schools in the United States second to none. One of the main goals

resulting from the conference read: "All workers will have the opportunity to acquire the knowledge and skills needed to adapt to constantly emerging new technologies, new work methods, and new markets through public and private vocational, technical, workplace, or other innovative programs" (Education Week, March 7, 1990, p. 16). If society is to adapt to the new changes of technology, then our educational programs must change. If this does happen, then technology education should become the NEW BASIC of education. The question is "Can we make the adjustments to make technology education a reality?" (Ritz, 1991, p. 4).

Business and Industry are also interested in changing education. In 1991, Lynn Martin, Secretary of the U.S. Department of Labor, organized a group of business people and educators known as the Secretary's Commission on Achieving Necessary Skills (SCANS). This Commission was directed to advise the Secretary of the skill levels needed by America's youth to gain initial employment. The Commission was also assigned the task of defining these skills, proposing levels of proficiency along with assessment, and developing a dissemination strategy for the nation's schools, businesses, and homes. After many discussions with owners, employers, union leaders, workers and supervisors, the committee outlined information related to five essential areas that future American workers will need to acquire prior to graduation from high school.

According to the SCANS Report, "The globalization of commerce and industry along with the explosive growth of technology on the job site has changed the terms for our young people's entry into the world of work" (SCANS, 1990, p. 3).

The five essential competencies reported by SCANS provide a direction for our schools, students, and businesses to prosper in a highly-advanced technological society. SCANS reported the following competencies needed to provide a foundation for job-performance. Today, workers must be capable of using:

1. **Resources** - allocating time, money, materials, space, and staff.

2. **Interpersonal skills** - working on teams, serving customers, leading, negotiating, and working well with people from a variety of cultures.

3. **Information** - acquiring and evaluating data, organizing, and maintaining files, interpreting and communicating, and using computers to process information.

4. **Systems** - understanding social, organizational, and technological systems, monitoring and correcting performance, and designing or improving systems.

5. **Technology** - selecting equipment and tools, applying technology to specific tasks, and maintaining and troubleshooting technologies (SCANS Report, 1991, p. 5).

There continues to be much confusion in the field of technology education and what we must do to develop programs to reflect the technological nature of our society. There have been numerous inservice training sessions to re-design

curriculums for technology education, but we must set a standard of what we find acceptable for the education of our society (Ritz, 1991, p. 5).

Traditional industrial arts programs have focused upon preparing students to utilize manipulative skills for constructing products and applying materials through various technical processes. These specific tool and machine processes contained in the industrial arts curriculum quickly became outdated due to rapid technological growth. On the other hand, a goal of Technology Education is to present students with a view of technology including its impacts on individuals, society, and the environment. It involves processes, systems and interactions that directly affect humans and the environment in which they live. Consequently, a certain amount of technology education programs have been implemented into schools throughout the United States and it is important to obtain an accurate assessment of the effectiveness of these programs. These programmatic changes may be assessed in a number of ways, each having their own advantages and limitations. As stated in a presentation document by Ritz which addressed the need for establishing evaluative criteria for Technology education programs (1992),

> The philosophies of Technology Education are not new (Martin, 1979). William E. Warner addressed programs of this nature in his curriculum to reflect industrial arts programs in the 1960's which

reflected the contemporary industry and technology of the 20th century. Paul DeVore provided much guidance during the past two decades to make us realize what technology education could become. And during the 70's and 80's, members of our profession have authored numerous publications and have discussed their ideas on implementing technology education programs, programs that were much different than their forerunner, industrial arts.

However, over the past few years, there remains little evidence supporting the increasing number of quality technology education programs throughout our nation's schools.

The Fifth Annual Survey of the Profession (Dugger, et.al., 1990, p. 28) reveals changes are occuring within our subject area as a gradual transition from industrial arts to technology education takes place. However, are these programs progressing in the right direction. The primary goal of this research was to develop and verify, through the Delphi technique, a list of measures that could be used to evaluate the progress from industrial arts to technology education. With this list of evaluative criteria, teachers and supervisors could assess their programs and set plans to work toward the establishment of true technology education programs.

Limitations

The following were the limitations that should be considered when reviewing this research study:

1. The Delphi used to create the list of criteria essential for a technology education programs will be limited to 28 technology education symposium

participants selected by the International
Technology Education Association (ITEA) and the
Council on Technology Teacher Education (CTTE).

2. The study was limited to technology education
   programs at the secondary level.

Assumptions

When considering the participants and conditions in

which this research was conducted, the following assumptions

have been determined for this particular study:

1. The symposium participants were in the position to
   create a list of criteria essential to technology
   education programs at the secondary school level.

2. The symposium participants have the necessary
   experience in secondary technology education to
   develop such a list of criteria.

Procedures

The initial list of participants attending the Symposium

on Critical Issues in Technology Education Toward the Year

2000 was obtained and the first round of the Delphi study

was distributed. The survey concentrated on answering one

important question: "What are the most essential criteria

that should be used to determine if a program is technology

education?" This concluded round one of the research

study.

In round two, the complete list of essential criteria

obtained from round one was redistributed to the

participants of this study. The symposium participants

rated each individual evaluative curriculum criteria based

upon a five point Likert scale. A Delphi design was

incorporated for the study, with the Symposium participants providing the collected data of the research study.

Definition of Terms

The following information was provided to insure that the reader of the study had an understanding of terms used that may be abstract or unfamiliar.

Technology Education – the study and application of the systems of technology including its impacts of technology on individuals, society, and the environment (Savage, 1990)

Criteria – a standard, rule, or test on which a judgement or decision can be based.

Industrial Arts – a project based approach in which the student is supplied with specific procedures to be followed in attaining the curricular goals.

Validate – to confirm or prove to be factual.

Overview of Chapters

In Chapter I, information was presented that dealt with the purpose of this research study in determining the criteria essential to establishing a quality technology education program. The problem limitations were stated, the assumptions were made and the procedures for this research study were explained.

Chapter II will discuss literature in relation to the study. Chapter III will outline detailed procedures for conducting the study. Chapter IV will contain the findings and Chapter V will provide a summary, conclusions and future recommendations for this study.

CHAPTER II

REVIEW OF LITERATURE

In Chapter II, Review of Literature, information related to this study will be presented supporting the need to develop essential curriculum criteria to aid in increasing the numbers of quality technology education programs within the public school environment. Included in this discussion were the following topics: (1) history, (2) technology education program evaluation, and (3) summary.

History

Setting standards for technology education programs at the secondary and university levels appears to be an ongoing process. In 1985, <u>Standards for Technology Education Programs</u> was produced by Dugger, Bame, and Pinder. This document outlined ten programmatic standards for technology education including:

1. Philosophy
2. Instructional programs
3. Student Population Served
4. Instructional Staff
5. Administration and Supervision
6. Support Systems
7. Instructional Strategies
8. Public Relations
9. Safety and Health
10. Evaluation Process

In 1992, The Council on Technology Teacher Education (CTTE) also established guidelines to prepare teachers to implement quality technology education programs. The CTTE

and the National Council for Accreditation of Teacher
Education (NCATE) designed a list of standards to assist
institutions in implementing changes in their curriculum
offerings from industrial arts teacher preparation to
technology education teacher preparation. This list of
programmatic standards included:

1. The curriculum is consistent with current
research findings.

2. Academic courses (mathematics, science,
general education) compliment technology
education.

3. Technology Education technical coursework of
an academic nature is offered.

4. Students learn to develop, manage and
evaluate school based programs.

5. Perspective teachers develop attitudes,
knowledge and skill in teaching.

6. Teacher candidates participate in an
appropriate student teaching experience
(Ritz and Loepp, editors, 1992).

In 1990, The National Association of State Directors of
Teacher Education and Certification (NASDTEC) updated and
reviewed programmatic standards for technology
teacher education. These included:

I. The program shall require demonstrated
knowledge of the historical and cultural
development of industry and technology and
their present and future impact on the
individual, society, and the environment.

II. The program shall require demonstrated
competence in the knowledge of the
foundations, philosophy, and principles of
the systems of technology including
communication, construction, manufacturing

and transportation.

III. The program shall require demonstrated competence in the knowledge of and experience in the areas of systems of technology with a concentration in at least one of these areas.

IV. The program shall require demonstrated competence in the knowledge of and experience in sketching, designing, drawing, and computer graphics.

V. The program shall require a wide variety of organized instructional experiences culminating in a demonstrated competence in the design, construction, and evaluation of individual and group projects through the use of the problem solving, creating, designing, and systems analysis.

VI. The program shall require demonstrated competence in the knowledge of and experience in planning and managing technology education programs.

VII. The program shall require demonstrated competence in the knowledge of career development and experience in assisting student in making decisions and occupational choices.

VII. The program shall require demonstrated competence in the basic knowledge of calculus, physics, and computer science and their application to technology.

The above standards for technology education developed by Dugger, Bame, and Pinder (1985), as well as the guidelines set forth by CTTE/NCATE and NASDTEC, specifically do not address activities that should take place in the technology education classroom/laboratory. The systems of technology (communication, production, transportation) are included, however, the standards are more programmatic than they are

curricular (Ritz, 1992, p. 3). Therefore, specific curriculum criteria for technology education programs is needed such that it can be easily observed through classroom/laboratory instruction.

Certainly the transition from industrial arts education to technology education has caused much confusion in the profession over the past few years. In 1988, John Holley of the Hawthorn Institute of Education (Australia) visited 22 North American states and provinces to observe the direction in which technology education was progressing. Since his study tour, at least six distinct programs descriptions under the title of technology education were identified (Ritz, 1992, p. 4). These include:

1. **Shop** - The program emphasis is on material usage and tool skill development. The construction of the project is the class outcome. Students memorize tools, machine parts, safety rules and types of materials and apply this knowledge to construct teacher designed projects.

2. **Industrial Arts** - The program emphasis is on the development of knowledge and skills of the process used by industry, i.e. drafting, woodworking, metalworking, etc. Project work continues to be the focus.

3. **Industrial Technology** - This is modern industrial arts. Focus continues to be on knowledge and skill development through learning processes used in modern industry. However, these programs bring in the new tools of technology such as computers, CNC mills and lathes, lasers, digital electronics, etc. Product and skill development continues to be major program outcomes.

4. **Design Technology** - This type of program originates from the British educational program of Craft, Design and Technology. Its focus is in the

development of problem solving skills with technological content becoming secondary.

5. **Technical Systems** - These programs study the application of modern systems of communication, construction, manufacturing and transportation. Emphasis is on systems resources, applications and outcomes (input-process-output model).

6. **Technology Education** - These programs emphasize the study and application of the systems of technology including communication, production and transportation. Study includes applying the technological method to design systems of technology. The impacts that the application of technology has on individuals, societies and the environment are major components of the program.

The above analysis of the directions in which technology education programs are headed provides a basis for the need to establish essential curriculum criteria to increase the numbers of viable technology education programs. Therefore, the question remains, "What do the leaders in the technology education profession consider to be vital in establishing quality technology education programs?"

Further support of the need to establish quality technology education programs began in the early 1980's. The United States, with a technological crisis at hand, placed responsibility on our schools and institutions to provide students with technical training required upon entering the "real world" (Bunting, 1987, p. 124). The surge towards, "excellence in education", as a whole, has caused schools to promote increased changes in "academic standards and stronger disciplinary codes" (Bunting, 1987, p. 124).

Certainly changes such as these have occurred many times over in years past. In 1905, in a report made by the Douglas Commission, the first sign of unskilled workers was appearing in the United States. By 1917, The Smith-Hughes Act had appropriated federal funds to industries to provide technical assistance and training to future workers. As we have witnessed recently, this still remains to be a problem in many areas of the country. Again in the late 1950's, the federal government found itself in crisis trying to remain a world wide leader in technological know-how. As a result, Congress the Vocational Education Act appropriating $60 million to industries, institutions, schools, and businesses (Suro, 1991, p. 20).

As early as 1957, the deficiency of unskilled labor and lack of prosperity caught up with the United States with the launching of the Soviet satellite Sputnik. This in turn caused the establishment of the National Defense Education Act. This document outlined many changes to be made to American school's science, mathematics, and social studies courses causing education involving technology to become national priority. Since this time, an awareness of technology education has increased and become a separate curriculum replacing the once narrow, outdated manipulative skills of industrial arts education (Oxford University Press, 1990, p. 48).

Further, The American Association for the Advancement of Science is in the fifth year of a 25 year project designed to improve and teach technological skills to the youth of America. This provided a "critical factor to the prosperity of the United States as well as to national security" (New York Times, 1991, p. 12).

Finally, on April 25, 1991, President Bush outlined 22 critical technologies known as the Defense Authorization Act. This document contained information on areas of development such as, materials testing and manufacturing, information, communications, biotechnology, life science, aeronautics, surface transportation, and energy (New York Times, 1989, p. 4).

Certainly this evidence supports the fact that technology education programs promise many different things to the future of our society. Therefore, these programs must become the NEW BASIC for educating the people in this country. The future of America and the prosperity of the people who dwell here are directly affected in part by the technology education programs that relate the instruction provided in the classroom/laboratory to situations confronted by the youth of our society each and everyday. The establishment of quality technology education programs continues throughout the United States. However, an evaluation process of these programs is needed.

Technology Education Program Evaluation

The purpose of this study is the development and validation of a set of measures that could be used to assess the effectiveness of a secondary level technology education programs. Many organizations that assess programs have in the past developed lists of criteria by following models previously presented by other authors. Each model has advantages as well as limitations. Therefore, this study will incorporate a mixture of different models discussed in Evaluating Instructional Programs (Tuckman, 1985).

The primary purpose of evaluating an instructional program is "to provide the means for determining whether the program is meeting its goals; that is, whether the measured outcomes for a given set of instructional inputs match the intended or previous outcomes" (Tuckman, 1985, p. 2). What then are these goals and intended outcomes?

In this evaluation process, three components are developed to address these questions. The first is a set of outcomes about which levels of attainment are of interest (objectives). The second is a set of standards or criteria of attainment on these objectives and the third is a set of measuring devices or tests that reveal actual levels of attainment on the chosen objectives (Tuckman, 1985, p. 4).

Basically, there are three approaches to evaluation of a program. The first approach is known as formative evaluation. It determines the extent to which measured

results on the objectives match intended results. The second approach, summative evaluation, determines the extent to which measured results on the objectives match or exceed results from alternative input systems; this determination should be done with both adequate certainty and generality. The third approach, ex-post facto evaluation, is a combination of the formative and summative evaluation processes (Tuckman, 1985, p. 4).

Therefore, it was important to identify a set of curriculum criteria essential to evaluating technology education programs. This list had to be assembled in order to enhance the quality of our technology education programs. This list of criteria could make the difference in the success or failure of many of the technology education programs implementation plans.

Summary

In light of the review of literature and the goals of this research study, the development of an evaluation design incorporated several different models. Tuckman's explanation of evaluation of instructional programs and measures reflecting the early stages of implementation of technology education programs were used in this process. Finally, as previously stated, there is much literature supporting the need to outline criteria essential in assessing technology education programs in the future.

Chapter III

METHODS AND PROCEDURES

The purpose of Chapter III was to present a discussion of the research methods and procedures that were used in this study. The population studied, the instruments used, the procedures for collecting the data, and the statistical analysis used will be defined and discussed. Chapter III is intended to allow the reader to understand what actually took place in the research study.

Population

The population of the study were teachers, teacher educators and supervisors labelled as leading practioners and advocates in technology teacher education by the International Technology Education Association (ITEA) and the Council on Technology Teacher Education (CTTE). The original population consisted of 28 individuals located throughout the United States and Canada.

Instruments

A similar instrument was used for both rounds of the Delphi study and the participants of the Symposium on Critical Issues in Technology Education Toward the Year 2000 received the same instruments at the same time. The first instrument (Appendix A) contained a list of evaluative curriculum criteria to assess technology education programs from the combined research of the ITEA (1985), Hughes

(1991) and Ritz (1985, 1990, 1991). The Symposium participants were asked to review the initial list of criteria and to validate the evaluative criteria needed to determine a quality technology education program. They were also requested to suggest other essential criteria not included in the list.

The second instrument (Appendix B) contained a list of the statements which corresponded to the list of evaluative criteria of round one as well as additional criteria mentioned by the symposium participants on the first round survey. It also included a Likert scale with a five-point scale for rating each of the individual evaluative curriculum criteria on a high-low continuum.

Both instruments in this study were designed to obtain the information needed to achieve the goals of this study. It was essential that each participant complete the surveys.

Data Collection Procedures

The purpose of this study was to produce a list of evaluative criteria essential to establishing a quality technology education program. Such a task could have been accomplished in an infinite number of ways. This author chose to employ the Delphi technique to gather information from participants attending the Symposium on Critical Issues in Technology Education Toward the Year 2000 comprised of technology teachers, teacher educators, and supervisors located in various states and Canada.

A Delphi technique makes use of opinion of experts for forecasting future events. It was developed by Norman Dalkey and Olaf Helmer at the RAND Corporation in California in the early 1950's (Fischer, 1964, p. 64). The Delphi technique attempts to allow for a more reliable consensus of the opinions to be obtained by the participants of the Symposium of Critical Issues in Technology Education Toward the Year 2000.

Round One

A cover letter and survey was distributed to all the participants attending the Symposium. The cover letter explained the purpose of the study. Each participant was also provided a copy of the survey. Along with the survey the participants were given instructions on how to answer the survey questions and when the survey was to be returned. The survey was administered on June 19 and due back on June 29, 1992. Upon completion of the survey, the participants' responses were recorded (Appendix C). This concluded round one of the Delphi study.

Round Two

Once the survey response for each participants in round one had been obtained, the survey responses were compared, recorded, and compiled into a second survey. The second survey was distributed on July 2 and due back on July 12, 1992. The goal of this survey was to provide feedback to

the symposium participants and to ask them to consider their own responses in comparison to the others. A five-point Likert scale which ranged from strongly agree to strongly disagree was used for this purpose.

Statistical Analysis

Included with the first survey of eight essential criteria were seven additional criteria which symposium participants deemed necessary to include in evaluating technology education programs. In round two, each participants' ratings for each of the individual criteria were tabulated. The mean score for each criteria was determined based upon the five point Likert scale.

Summary

The results of this study may determine the criteria essential to technology education programs at the secondary level. The instrument contained in this chapter may serve as a plan for implementation of quality technology education programs.

The next chapter, Findings, will present and summarize the data from this two round Delphi study. Mean scores for each evaluative curriculum criteria for technology education programs are given. Chapter V presents conclusions and recommendations from the data obtained in this study.

Chapter IV

FINDINGS

The data collected for this study were summarized in this chapter. Research questions regarding essential evaluative criteria for techology education programs were addressed by obtaining judgmental data from participants of the Symposium on Critical Issues in Technology Education Toward the Year 2000. The study consisted of a two-round Delphi survey. Included in this discussion were the following topics: (1) respondents, (2) round one, (3) round two, and (4) summary.

Respondents

The population for this study consisted of twenty-eight participants of the Symposium on Critical Issues in Technology Education Toward the Year 2000. The participants included technology teachers, teacher educators, and supervisors from throughout the United States. A complete list of these participants appears in Appendix D.

Round One

On June 19, 1992, the round one survey was distributed to twenty-eight participants attending the Symposium on Critical Issues in Technology Education Toward the Year 2000. Twenty-two of the surveys were returned, which was 79 percent of those distributed.

The goal of the first round was to identify Delphi participants and to begin the process of determining

essential curriculum criteria for Technology Education programs. This was accomplished with a list of eight essential criteria prepared by Ritz (1992) as well as space provided for additional criteria in which participants felt necessary to include in order to assess Technology Education programs at the secondary level. Seven additional criteria were listed with several participants listing more than one criteria essential in evaluating technology education programs. Most surveys contain very few additional criteria and in such cases, there is no way of determining which of these criteria was most important. Therefore, all of the initial eight criteria and the seven additional criteria were listed on the second round survey. Listed in Table 1 are the initial eight criteria and seven additional criteria essential for evaluating Technology Education programs at the secondary level.

Table 1

Criteria Essential to Technology Education

1. Analyze the behavior of technological systems (production, communication, and transportation.

2. Apply knowledge about the dynamics of technology including its development and potential.

3. Identify, select, and apply technological resources to satisfy human purposes.

4. Employ the technological method to solve technical problems and extend human potential.

5. Utilize practical activities where one proceeds from concrete technological experiences to the abstract concepts of science, mathematics and society.

Table 1 - continued

6. Assess the impact technology has had and may have on individuals, societies and the environment.

7. Project possible areas of future technological development.

8. Use history to learn about future technological development.

9. Assumes the disciplines of engineering and technology which already exist and are accepted by society.

10. Make ethical decisions based on the impact technology has on the individual, society and the environment.

11. To develop lifelong learning patterns.

12. Project technology from international, multicultural, gender, and minority perspectives.

13. Work with tools and materials to solve technological problems and meet opportunities in both individual and cooperative group situations.

14. Use microprocesses/thinking to solve macro problems related to technology.

15. Developing an assessment and evaluation strategy toward Technology Education.

These fifteen criteria were used in the second round survey and no changes were made to the wording of this list of curriculum criteria essential to evaluating technology education programs at the secondary level.

Round Two

The initial list of criteria as a result of the first round survey were rank ordered according to the number of participants responses. The second round survey was returned to the twenty-two symposium participants on July 6, 1992.

The goal of this round was to provide feedback and ask the symposium participants to consider their own responses in comparison to the others. The participants were encouraged to use the following five-point Likert scale to differentiate among the responses:

     SA = Stronly Agree
      A = Agree
      U = Undecided
      D = Disagree
     SD = Strongly Disagree

Nineteen of the twenty-two symposium participants returned the surveys from the second round of the Delphi. The data were assigned the following numerical values by the researcher:

     5 = Strongly Agree
     4 = Agree
     3 = Undecided
     2 = Disagree
     1 = Strongly Disagree

A mean score was calculated for each essential criteria listed using the above assigned numerical values. Scores were rounded to the nearest hundredth to distinguish between the needed and unneeded criteria for evaluating technology education programs. The criteria along with their mean scores are listed in Table 2.

Table 2

Group mean scores of essential curriculum
criteria for technology education

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Curriculum Criteria for Technology Education	Mean
1. Analyze the behavior of technological systems (i.e. production, communication, transportation.	4.32
2. Apply knowledge about the dynamics of technology including its development and potential.	4.58
3. Identify, select, and apply technological resources to satisfy human purposes.	4.32
4. Employ the technological method to solve technical problems and extend human potential.	4.63
5. Utilize practical activities where one proceeds from concrete technological experiences to the abstract concepts of science, mathematics and society	4.37
6. Assess the impact of technology has had and may have on individuals, societies, and the environment.	4.58
7. Project possible areas of future technological development.	4.32
8. Use history to learn about future technological development.	4.00
9. Assumes the discipline of engineering and technology which already exists and are accepted by society.	3.74
10. Make ethical decisions based on the impact technology has on the individual, society, and the environment.	4.47
11. To develop lifelong learning patterns.	4.26
12. Project technology from international, multicultural, gender, and minority perspectives	3.89

Table 2 - continued

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================================================================
    Curriculum Criteria for Technology Education        Mean
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13. Work with tools and materials to solve tech-
    nological problems and meet opportunities in
    both individual and group situations.   4.32

14. Use microprocesses/thinking to solve macro
    problems related to technology.   3.79

15. Developing an assessment and evaluation strat-
    egy toward technology education.   4.00

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The mean scores for curriculum criteria essential to

technology education programs ranged from 4.63 to 3.74 in

the second round. The participants assigned the highest

score to "Employ the technological method to solve technical

problems and extend human potential." The lowest score of

the second round was assigned to "Assumes the disciplines of

engineering and technology which already exist and are

accepted by society."

Summary

In this study, a consensus for identifying and

validating a list of essential curriculum criteria for

evaluating technology education programs was achieved. To

avoid biased effects resulting from pressure of group

conformity, a two round Delphi study was employed to involve

the opinions of the participants of the Symposium on

Critical Issues in Technology Education Toward the Year

2000.

The procedure began with a survey containing a list of eight criteria deemed essential to technology education and space provided to identify any additional criteria symposium participants felt necessary to include in evaluating technology education programs. These responses to the survey were gathered and returned to the participants for their consideration using a five point Likert scale. The results of this round were tabulated and the mean score for each response was calculated.

The data for this study were presented and summarized for this chapter. In the final chapter, a summary of the research is presented, conclusions are drawn and future recommendations are made.

Chapter V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

The problem of this study was to identify and validate a list of curriculum criteria essential to evaluating technology education programs at the secondary level. The previous chapters of this study included information gathered for the purpose of achieving this goal. Included in this final chapter of this study were the following topics: (1) summary, (2) conclusions, (3) and recommendations.

Summary

This research study has presented a problem that is valid to all technology education programs at the secondary level. Technology education programs have undergone many changes. In order to keep pace with our ever changing society, programs in technology education must change appropriately. What essential criteria is needed to assess the effectiveness of change to technology education? This study was undertaken to identify and validate a list of curriculum criteria needed to evaluate technology education programs at the secondary level.

The two-round Delphi survey was administered to 28 participants of the Symposium on Critical Issues in Technology Education Toward the Year 2000. A total of 19 surveys were returned which was 68 percent of those

distributed. In Chapter IV, Findings, the criteria found essential for technology education were identified.

Conclusions

The first research goal of this study was to determine a list of evaluative curriculum criteria essential to technology education programs at the secondary level. The results showed that the participants of the Symposium on Critical Issues on Technology Education Toward the Year 2000 listed fifteen essential curriculum criteria for technology education. These included:

1. Analyze the behavior of technological systems (production, communication, and transportation.

2. Apply knowledge about the dynamics of technology including its development and potential.

3. Identify, select, and apply technological resources to satisfy human purposes.

4. Employ the technological method to solve technical problems and extend human potential.

5. Utilize practical activities where one proceeds from concrete technological experiences to the abstract concepts of science, mathematics and society.

6. Assess the impact technology has had and may have on individuals, societies and the environment.

7. Project possible areas of future technological development.

8. Use history to learn about future technological development.

9. Assumes the discipline of engineering and technology which already exist and are accepted by society.

10. Make ethical decisions based on the impact technology has on the individual, society, and the environment.

11. To develop lifelong learning patterns.

12. Project technology from international, multicultural, gender, and minority perspectives.

13. Work with tools and materials to solve technological problems and meet opportunities in both individual and cooperative group situations.

14. Use microprocesses/thinking to solve macro problems related to technology.

15. Developing an assessment and evaluation strategy toward technology education.

The second research goal of this study was to validate the list of curriculum criteria essential to technology education programs at the secondary level. Since a mean score of over 3.5 represented agreement by the participants of the Symposium on Critical Issues in Technology Education Toward the Year 2000, all the above curriculum criteria for evaluating technology education programs were considered to be important.

Technology Education will succeed as part of our educational system by making contributions to education and society through the envisions of the professional educators in this field. The establishment of evaluative criteria to judge the quality of a particular technology education program is essential. This research study has shown a general concensus on what quality technology education programs should offer to our public school youth.

Recommendations

It is evident when reading this research study and examining its findings that a list of essential curriculum criteria for evaluating quality technology education may be established through the efforts of leading practitioners in this field. We can conclude that this list of criteria can promote the success or failure of technology education programs in the future.

The list of curriculum criteria identified and validated by this research study should aid in increasing the number of quality technology education programs throughout the United States. The following are recommendations that should be reviewed by the profession as it moves toward this goal.

1. The criteria identified and validated may be used by teachers, teacher educators, and supervisors to offer a direction for present and future technology education programs. This can be accomplished by giving workshops and seminars that include a review of this list.

2. The International Technology Education Association should present special workshops to to technology teachers to aid in identifying, validating and modifying future criteria essential to technology education.

3. Universities should restructure their teacher preparation programs to ensure graduates are exposed to this list of curriculum criteria for technology education programs at the secondary level and that future teachers learn to use these in developing and teaching their programs.

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APPENDICES

APPENDIX A - Round One Survey and Cover Letter

APPENDIX B - Round Two Survey and Cover Letter

APPENDIX C - Tabulated Responses Received from the
First Round of the Delphi Study

APPENDIX D - List of Participants of this Study

APPENDIX A

ROUND ONE SURVEY AND COVER LETTER

Office of the Chair
(804) 683-4305

Adult Education
683-3307

Graduate Vocational
Education
683-4305

Marketing Education
Training Specialist
Fashion
683-3307

Technology Education
Industrial Technology
683-4305

June 19, 1992

Dear Symposium Participant:

Technology Education is a relatively new concept for the field of education. Recent attempts to implement it into our schools have met with varying degrees of success. To assist the profession in implementing programs, evaluative criteria will be useful. Identifying these criteria can assist teachers in their transistion toward a true technology education program. A Delphi study is presently being conducted to identify and validate a list of evaluative criteria for Technology Education programs. As leaders in the profession, it is our responsibility to establish criteria to guide the technology education profession as it continues to mature during the early 21st century.

To do this, a survey containing a list of evaluative criteria is being distributed to all participants of the Symposium on *Critical Issues in Technology Education Toward the Year 2000*. This list of evaluative criteria was developed through research by Ritz (1985, 1990, 1991), the ITEA (1985) and Hughes (1991).

Please complete and return the attached survey to insure that your response is included in this study. We thank you for your assistance in this information gathering process.

Sincerely,

Jason E. Perry
Graduate Teaching Assistant

John M. Ritz, DTE
Professor and Chair

jep

Enclosure

Survey for Identifying Evaluative
Criteria for Technology Education Programs

Purpose:

This survey is designed to identify curricular criteria for Technology Education programs as addressed by the participants of the Symposium on *Critical Issues in Technology Education Toward the Year 2000.*

Directions:

Please review the following list of evaluative criteria for Technology Education programs. Place a check mark beside the criteria you feel are necessary to reflect Technology Education programs. Space below is provided for additional criteria you feel are essential in establishing a Technology Education program.

❏ Analyze the behavior of technological systems (i.e. production, communication, etc.).

❏ Apply knowledge about the dynamics of technology including its development and potential.

❏ Identify, select, and apply technological resources to satisfy human purposes.

❏ Employ the technological method to solve technical problems and extend human potential.

❏ Utilize practical activities where one proceeds from concrete technological experiences to the abstract concepts of science, mathematics and society.

❏ Assess the impact technology has had and may have on individuals, societies and the environment.

❏ Project possible areas of future technological development.

❏ Appraise personal interests and abilities related to a variety of technology-oriented careers.

Please list below any additional criteria essential in establishing a Technology Education program:

Name: _____

Address: _____

_____

Telephone: _____

APPENDIX B

ROUND TWO SURVEY AND COVER LETTER

OLD DOMINION UNIVERSITY

Department of Occupational and Technical Studies
Norfolk. Virginia 23529

40

July 9, 1992

Address

Dear

Office of the Chair
(804) 683-1305

Adult Education
683-3307

Graduate Vocational
Education
683-1305

Marketing Education
Training Specialist
Fashion
683-3307

Technology Education
Industrial Technology
683-1305

Thank you for agreeing to participate in our research and providing your perceptions of essential evaluative criteria for Technology Education programs. The quality and quantity of the responses received indicate a strong interest in this topic by the symposium participants of the *"Critical Issues in Technology Education Toward the Year 2000."* The first survey was designed to elicit individual judgements from each of the symposium participants selected for this study.

The goal of the second round is to provide feedback from the previous survey to all symposium participants and to ask you to consider the importance of the following draft list of essential evaluative criteria.

Please complete this round as soon as possible and return it to us by July 19, 1992. You may eithor FAX (804-683-5227) your response to us or mail it directly. Again thank you for your assistance and we look forward to hearing from you soon.

Sincerely,

Jason E. Perry
Graduate Teaching Assistant

Dr. John M. Ritz
Professor and Chair

jep

Enclosure

# Validating Evaluative Criteria for Technology Education Programs

Purpose:

This survey is designed to validate critieria essential to Technology Education programs by *The Critical Issues in Technology Education Toward the Year 2000* symposium participants. A Delphi technique is being used to achieve this purpose. The goal of this second round is to provide the feedback from the previous survey to all symposium participants and to ask you to consider the importance of the following draft list of essential evaluative criteria.

Directions:

All the evaluative criteria for Technology Education programs identified by symposium participants have been ranked. You are being asked to consider the responses to each of the criteria separately.

Please read all the Technology Education program criteria and indicate the extent of your agreement or disagreement with each criteria. You are encouraged to differentiate among these by using the following rating scale.

SA	A	U	D	SD
Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
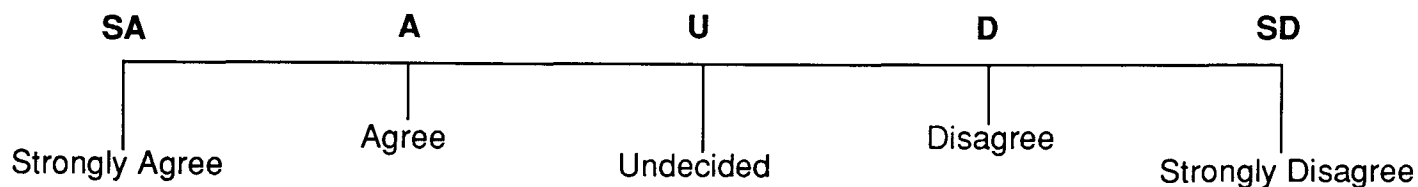
Circle your choice:

SA A U D SD   Analyze the behavior of technological systems (i.e. production, communication, transportation).

SA A U D SD   Apply knowledge about the dynamics of technology including its development and potential.

SA A U D SD   Identify, select, and apply technological resources to satisfy human purposes.

SA A U D SD   Employ the technological method to solve technical problems and extend human potential.

SA A U D SD   Utilize practical activities where one proceeds from concrete technological experiences to the abstract concepts of science, mathematics and society.

SA A U D SD   Assess the impact of technology has had and may have on individuals, societies and the environment.

SA A U D SD   Project possible areas of future technological development.

Validating Evaluative Criteria for Technology Education Programs

Circle your choice:

SA   A   U   D   SD   Use history to learn from future technological development.

SA   A   U   D   SD   Assumes the disciplines of engineering and technology which already exist and are accepted by society.

SA   A   U   D   SD   Make ethical decisions based on the impact technology has on the individual, society, and the environment.

SA   A   U   D   SD   To develop lifelong learning patterns.

SA   A   U   D   SD   Project technology from international, multicultural, gender, and minority perspectives.

SA   A   U   D   SD   Work with tools and materials to solve technological problems and meet opportunities in both individual and cooperative group situations.

SA   A   U   D   SD   Use microprocesses/thinking to solve macro problems related to technology.

SA   A   U   D   SD   Developing an assessment and evaluation strategy toward Technology Education.

Name: _____

Address: _____

_____

Telephone: _____

Thank you for your assistance in this information gathering process.

Jason E. Perry
Graduate Teaching Assistant
Old Dominion University

APPENDIX C

TABULATED RESPONSES RECEIVED FROM THE FIRST

ROUND OF THE DELPHI STUDY

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CRITERIA LISTED BY SYMPOSIUM PARTICIPANTS	NUMBER OF RESPONSES
Analyze the behavior of technological systems (i.e. production, communication, transportation.	20
Apply knowledge about the dynamics of technology including its development and potential.	22
Identify, select, and apply technological resources to satisfy human purposes.	20
Employ the technological method to solve technical problems and extend human potential.	20
Utilize practical activities where one proceeds from concrete technological experiences to the abstract concepts of science, mathematics and society.	20
Assess the impact of technology has had and may have on individuals, societies, and the environment.	20
Project possible areas of future technological development.	19
Use history to learn about future technological development.	17
Assumes the discipline of engineering and technology which already exists and are accepted by society.	1
Make ethical decisions based on the impact technology has on the individual, society, and the environment.	1
To develop lifelong learning patterns.	1
Project technology from international, multicultural, gender, and minority perspectives	1
Work with tools and materials to solve technological problems and meet opportunities in both individual and group situations.	1
Use microprocesses/thinking to solve macro problems related to technology.	1
Developing an assessment and evaluation strategy toward technology education.	1

APPENDIX D

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