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The Willingness of Technology Teachers to Support the Standards of Learning (SOL) Objectives

James W. Lambert
Old Dominion University

THE WILLINGNESS OF TECHNOLOGY TEACHERS TO SUPPORT THE STANDARDS OF LEARNING (SOL) OBJECTIVES

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JAMES W. LAMBERT

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Approved by: John M. Ritz 2-28-00

Dr. John M. Ritz
Graduate Program Director
Occupational and Technical Studies
Old Dominion University

Date

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INTRODUCTION

Virginia's Board of Education has worked with citizens and educators to establish high academic expectations and goals for our schools and children. The Standards of Learning (SOL) are the products of this labor. Adopted in June 1995, they outline reasonable expectations and establish requirements for students in four core areas: English, mathematics, science and history. SOL assessments take the form of standardized tests given to students in grades 3, 5, and 8 as well as those in certain high school courses. The first SOL tests were administered in the spring of 1998.

The new SOLs are important because they provide the standard or set the framework for what teachers need to teach and students need to learn. The Board of Education feels "clear, concise academic standards will let parents and teachers know what is expected of students, and each student's performance and achievement can be measured against the standards" (Bosher, 1995, p. 2).

The 1999 School Performance Report is out and as expected the Old Dominion's school systems scored low in all four-core content areas. The Board of Education feels that Virginia's schools should be accountable for the progress students make in meeting these high academic standards. If the SOL scores do not improve over the next two to three testing cycles, individual public schools could lose their accreditation and students who do not pass the test will not be promoted or allowed to graduate. For that reason, it is imperative that schools and individual

teachers devise a strategy to achieve an acceptable level of performance on the SOL.

Given the necessity for SOL scores to improve, this research will focus on the technology teacher's willingness to apply interdisciplinary teaching methods to the classroom environment and team up with teachers representing the four core areas in using technology courses to assist in teaching and enforcing the academic competencies that relate to core requirements.

Statement of the Problem

The problem of this study was to assess the attitudes of technology education teachers in the state of Virginia to develop a comprehensive teaching plan to include the SOL core area course competencies into Technology Education course curriculum.

Research Goals

To answer this problem, the following goals were developed:

1. Determine whether technology teachers were willing to establish a goal of improving SOL competency scores both locally and regionally?
2. Determine if teachers stress the competencies identified in the Technology Education Course Competencies Related to Academic Standards of Learning publication in support of the program objectives at their schools?
3. Make recommendations on how teachers can better support the teaching of academic SOL through technology education.

Background and Significance

Technology Education is fundamental to a practical educational plan that meets the needs of all Virginia's students. With the advent of the SOL, it has become increasingly more important. Educators must take advantage of each opportunity to reinforce the SOL competencies. Where students may have a difficulty associating a particular concept in mathematics it may become clearer when associated or discussed in a computer science class. Teachers must be willing to take advantage of all opportunities to reinforce each other's curriculum. Under the direction of Dr. Arvid Van Dyke, James Madison University, several teams of Virginia technology educators undertook an exhausting review of eight technological programs that included 24 technology classes. The programs they reviewed and validated were:

- Middle School *Explorations in Technology* Program
- High School *Design and Technology* Program
- High School *Pre-Engineering* Program
- High School *Communications and Information Technology* Program
- High School *Control Technology* Program
- High School *Production Technology* Program
- High School *Technical Design and Illustration* Program
- High School *Principles of Technology* Program

In addition to the teams of researchers/teachers who identified the SOL competencies contained within these technology education classes, there were also leaders from Virginia's business and industry community who validated the findings. The finding were published by the Commonwealth of Virginia in the "Technology Education Course Competencies with Related Academic Standards of Learning". This publication identifies those SOL core requirements that were reinforced in the technology education programs. The publication was validated and is a resource for technology teachers who are planning for partnership or cooperative classroom instruction with academic teachers. This study will determine the interest or willingness of technology teachers to apply these academic course competencies in support of the SOL. If a plan can be devised and implemented by a majority of technology teachers, then one more weapon can be added to fight against ignorance.

Limitations

The limitations of the study included the following:

1. The study was conducted during the academic school year, 1999-2000.
2. The study only included members of the Virginia Technology Education Association.
3. A survey using the World Wide Web (www) and e-mail addresses were used to collect all data used in this study.
4. The Virginia Technology Education Association provided the e-mail addresses for the participants.

Assumptions

The researcher made the following assumptions as this study related to technology education teachers:

1. All people who completed the survey were technology education professionals working in the Virginia public school system.
2. The technology teachers would voluntarily provide the information. Local school districts policies, procedures and school locations (inner-city/suburbs) would not bias the survey.
3. Technology education is an applied subject area which can assist students in mastering abstract academic concepts.

Procedures

The subjects of this study were technology education professionals from Virginia. A questionnaire was developed by the researcher to answer the research goals. It was e-mailed to the participants and was used to provide the data needed for this study.

Definition of Terms

The following definitions were provided to assist the reader:

School Accreditation: The Regulations Establishing Standards for Accrediting Public Schools in Virginia, adopted by the Board of Education in September 1997, outline the expectations for schools in the Commonwealth. Each school in Virginia will be awarded an annual accreditation rating. During 1998-1999, all

Virginia public schools were Provisionally Accredited. In subsequent years, school accreditation ratings will be based on the performance of students on the SOL tests.

School-Wide Scores: Student achievement on English, mathematics, science, and history SOL tests is reported as a scaled score at both the total test level and in the reporting categories for the test. Scaled scores for a total test range from 0-600. A scaled score of 400 or higher is needed to pass each test. Scaled scores for a test reported on the School Performance Report Card for a school are the average scaled scores earned by those taking the tests in that school. Additional information is also provided beyond the total scores for a SOL test. Each test is divided into report categories that represent different segments of the content on the test. The average scaled score for each reporting category is 35, which serves as a point of reference for future test administrations. The reporting category scaled scores shown on the School Performance Report Card are the average scaled scores earned by those in that school taking the test. All scaled scores in the School Performance Report Card for this exclude the performance of limited English proficient students.

World Wide Web: Often referred to simply as the Web, it is a service that allows computer users to quickly and easily navigate the Internet, the international collection of thousands of interconnected computer networks.

Overview of Chapter

In Chapter I of this study, the problem, research goals and limitations were identified. The problem focused on the willingness of technology teachers in the state of Virginia to apply established course competencies in support of the SOL core requirements. Research goals were directed towards determining to what extent technology teachers would support local and regional efforts to increase the SOL scores.

Chapter II will provide an analysis and examination of the literature associated with the Standards of Learning and cooperative classroom instruction. Chapter III will explain the methods and procedures used to conduct the study. Chapter IV lists the findings of this study. Chapter V summarizes the study to include conclusions and recommendations for future studies.

CHAPTER II

REVIEW OF LITERATURE

This chapter is a review of selected literature found by the researcher related to the topic of this research. This chapter will include information obtained from educational journals, case studies, as well as electronic media from the Internet. Through the review of the literature, the researcher has determined that there are no studies on course curriculum changes initiated by a group of technology educators. For this reason, the researcher has focused on the following general areas that have had a positive impact on improving academic performance.

1. Why integrate academic and vocational teaching?
2. Integrating reforms into current systems.
3. Using technology to improve teaching and staff development.
4. Summary.

Why Integrate Academic and Vocational Teaching

The Commonwealth of Virginia, Department of Education, released a MEMO dated May 15, 1998. The Superintendent of Public Instruction, Paul D. Stapleton, announces that there were $25.1 million dollars available to support teachers, principals, superintendents, and other administrators in implementing the SOL and the Standards of Accreditation (SOA). The goal of this initiative was to improve the student's success rate on the Standards of Learning tests. This incentive was available for any school or school system willing to devise and implement methods and procedures that would enhance student proficiency in the SOL examinations.

Integrating academic and vocational teaching and just what criteria to use in determining whether a school or school system should integrate competencies is the question that needs answered first. Dr. Gene Bottom (Director of the Southern Regional Education Board's High School that Work program) in his study, *Integrating Academic and Vocational Teaching*, offers this guidance and provides a starting point. At a minimum, the following questions need to be answered to determine if change is necessary.

1. Are your high school graduates able to use mathematics content from algebra, geometry and statistics to solve three to five-step mathematics problems typically found in work setting?
2. Can your graduates locate, read and interpret several items of information and organize them into a report?
3. Can your graduates relate key biology, chemistry and physics concepts and principles to their career fields?
4. Did your academic and vocational teachers visit and observe in each other's classrooms to work on ways to advance students' academic and technical learning?
5. Do academic and vocational teachers make joint assignments leading to grades given in both classes?
6. Do all classes have challenging assignments outside of class?
7. Do your students use mathematics to complete work-related projects and to make oral reports in class?

8. Are your twelfth-graders required to complete a senior project (consisting of a written report, an oral report and a product) on an occupational or community topic? (Bottom, 1995, p. 133)

Bottom states that if you answer no to anyone of these questions, then "integrating academic and vocational learning needs to be a top priority at your school." (Bottom, 1995, p. 133)

Bottom's work with Georgia's *High Schools that Work Program* (1987) identified several reasons for merging the curriculums based on his experiences and observations. Among them were:

- Integrated studies keep alive a "yearning for learning" among youth.
- Integrated learning is how people learn in the real world.
- Academic and vocational integration improves the academic achievement of more students.
- Integrated learning helps students make education and career plans.
- Integrated learning promotes success for more students.
- Integrated learning helps academic and vocational teachers expand their repertoire of teaching strategies.
- Integrated learning promotes professionalism among teachers as they work together to raise students achievement.
- Integrated learning builds parent and community support.

Once the decision is made to integrate academic and vocational curriculums, it must be carefully planned. "Effective integration that advances students learning is not easily or quickly achieved. It requires creative, hard-working teachers, an

active and supportive administration, a willingness to use resources, and take risk." (Bottom, 1995, p.145).

A study conducted at James Madison University resulted in the printing of the *Technology Education Course Competencies with Related Academic Standards of Learning* publication. It integrates the common SOL course competencies into existing technology courses. The detailed information contained in this publication, if applied, would greatly advance any local or school system initiative for reform and possibly improve the overall performance of Virginia's students on the SOLs tests. Appendix A is an excerpt from this publication.

Integrating Reforms into Current Systems

Integrating reforms into your current school system is a concept that must be understood and not rushed into place. Once you have determined to integrate your academic and technology curriculums, short and long-term goals need to be made and a plan devised to assist in the achievement of these goals.

Rene Leger, the Business Partnership Coordinator for the Roosevelt Renaissance 2000 program, has been instrumental in incorporating a comprehensive school-to-work program in Roosevelt High School in Portland, Oregon. In his article, *Integrating Reforms into Your Current System*, he details the methods and procedures the faculty and local business leaders used in achieving their goals. Implementing a school to work system is not the same as integrating academic and technology curriculums, but the concept of changing attitudes and shifting paradigms are. Leger found that he needed to spend more time working with school administrators and teachers than he did with the local

business community. "To build a successful program, I would need their perspectives and consensus on program goals. Without their support, I would be operating in a vacuum and there would be little hope of integrating the program into mainstream student activities." (Leger, 1989, p.197)

The guiding principles or steps used by Leger in his efforts at Roosevelt High School can and should be applied when integrating academic course competencies into the technology education curriculum. The following is a sampling of these steps and determinations he made. They included:

- The willingness of teachers and school officials to advance the initiative where determined.
- A mission statement was prepared that targets all students.
- Goals were established and plans devised for their achievement.

These steps were not all inclusive but they were fundamental to the success achieved at Roosevelt High School in their efforts at making an academically and potentially economically enhancing changes for their students.

Using Technology to Improve Teaching and Staff Development

The research points to the teacher as being the primary focal point in any change to an existing structure. Without their support, the change is doomed. Kathleen Fulton, the Associate Director, Center for Learning and Educational Technology, College of Education at the University of Maryland, discusses her finding with Dennis Sparks, staff writer for Journal of Staff Development (JSD). As the director for the study, *Teachers and Technology: Making the Connection,* Fulton believes "that teacher support must include giving teachers time to

experiment, permission to change the way they do things, and even to make some mistakes. (Sparks, 1998, p. 18) To make any fundamental changes in course curriculums, teachers must support it and be given the opportunity to do a self-assessment to determine for themselves a need for the change and how the change should be implemented.

"Staff development should be tailored to individual teachers or small groups of teachers, not a one-size-fits-all generic model." Further, "It's much easier for teachers to use technology to do what they're always done - like automating their grade books - than it is for them to make significant changes in their basic approach to teaching and learning." (Sparks, 1998, p. 19) The research suggests that for any initiative to be successful, the teacher's opinions, ideas and concerns have to be taken into consideration. They must have input before the change is made and as much as possible their opinions and ideas must be incorporated in this change. Teachers have to be allowed to take ownership of the process and at every opportunity their input should be sought out, considered and if feasible, implemented where possible.

Summary

After a review of the literature, the researcher has determined that the SOL course competencies can be enhanced by those listed in *Technology Education Course Competencies with Related Academic Standards of Learning Publication.* There is now incentives both academically and financially for schools and schools systems to actively pursue engineering new methods of instruction to enhance the bottom line in the SOL arena. History has proven

those projects such as work-based learning and integrating academic and vocational teaching can be implemented with outstanding results. The keys to their successes are directly contributed to the level of support, detailed planning and coordination of efforts of all involved.

During the review of literature, the researcher identified one underlining premise in all the case studies reviewed. Educators who maintain their focus on the students have set in motion positive changes for their students and enhanced the skills of their teachers. Technology teachers must take a proactive role in support of the SOL by providing the leadership, initiative and expertise required to incorporate the technology course competencies with the SOL course competencies when the opportunity presents itself.

CHAPTER III

METHODS AND PROCEDURES

The purpose of this chapter is to identify the methods and procedures used to gather the data necessary for this study. Additionally, other subject matter presented will consist of the population who participated in the study, the instrument design, method of data collection, statistical analysis, and concluding with a summary.

POPULATION

The populations targeted for this study were educational professionals currently teaching technology courses at the middle and high school level. There were 60 teachers selected from various schools system throughout Virginia to participate in the survey. Without exception, all were members of the Virginia Technology Education Association.

INSTRUMENT DESIGN

The instrument used for data collection was written and designed by the researcher. This instrument encompassed a narrow range of material concerning the Standards of Learning and information that pertained only to the current study. This survey included questions pertaining to the SOL and technology teachers' willingness to support the SOL core course competencies with technology course competencies. Further, were teachers willing to support this goal on regional or state levels? The target population was asked if they were

willing to attend a regional conference to discuss the issues of the Standards of Learning and technology education. A copy of the instrument is located in Appendix B.

DATA COLLECTION

The data was collected during the months of September through November 1999. A period of two months was establish to issue and collect surveys from the population. The surveys were sent via the World Wide Web as e-mail attachments by the researcher on September 21 and again on October 15, 1999. The population was asked to response as soon as possible. The population either responded via the World Wide Web or used the U.S. Postal Service. The researcher completed his survey on November 25, 1999.

STATISTICAL ANALYSIS

The completed questionnaires were collected, sorted, compiled and tabulated by the researcher. The number and frequency of responses for incorporating academic and technology course competencies was properly recorded. Tables were designed to display the total numbers of the target population, the percentage of response to particular answers and their mean.

SUMMARY

Chapter III described the population consisting of 60 educational professionals from various schools districts throughout Virginia. The design of

the instrument and the methods used to distribute the survey to the population were discussed. The methods and procedures used to collect, sort, and tabulate the data received were also discussed. The analysis of the data will be presented in Chapter IV.

CHAPTER IV

FINDINGS

The problem of this study was to determine the attitudes of technology teachers in the state of Virginia to develop a comprehensive teaching plan to include the SOL core area course competencies into Technology Education course curriculum. In order to obtain the data, a survey was sent to 60 members of the Virginia Technology Education Association (VTEA). Of the 60 surveys sent, 20 were returned and the data obtained was computed, analyzed and displayed. This was a 33% response rate.

A Likert scale was used as the basis for the calculation of the mean. Strongly Agree (SA) was assigned a value of 5, Agree (A) a value of 4, Uncertain (UNC) a value of 3, Disagree (D) a value of 2, and Strongly Disagree (SD) a value of 1.

The following is an analysis of the survey questions.

Question 1: How do you feel about Virginia's stress on academic competencies?

Table 1 provides an analysis of the responses to this question. Three (15%) of those that responded strongly agreed. Six (30%) of those that responded agreed. Seven (35%) were uncertain and 4 (20%) disagreed. The mean calculated was 3.4 and it indicates that the target population is uncertain how they feel about Virginia's stress on the academic course competencies.

Table 1. Question 1 Statistical Analysis

SA	%	A	%	UNC	%	DA	%	SDA	%	X
3	15	6	30	7	35	4	20	0	0	3.4

Question 2: Do you feel that technology education teachers should structure their courses to reinforce the academic competencies?

Table 2 provides an analysis of the responses to this question. Two (10%) of those that responded Strongly Agreed. Twelve (60%) that responded Agreed. Two (10%) were Uncertain, 2 (10%) Disagreed and 2 (10%) Strongly Disagree. The mean calculated was 3.5, which indicates that the target population agrees that technology education teachers should structure their courses to reinforce the academic competencies.

Table 2. Question 2 Statistical Analysis

SA	%	A	%	UNC	%	DA	%	SDA	%	X
2	10	12	60	2	10	2	10	2	10	3.5

Question 3: Do you feel that the technology education curriculum should stand-alone and not contribute to students' achievement of academic competencies?

Table 3 provides an analysis of the responses to this question. No one (0%) either strongly agreed or agreed. Two (10%) were uncertain. Fourteen (70%) disagreed and 4 (20%) strongly disagreed. The mean calculated to be 1.9, which indicates that the target population disagrees with the statement that the technology education curriculum should stand-alone and not contribute to students' achievement of academic competencies.

Table 3. Question 3 Statistical Analysis

A	%	A	%	UNC	%	DA	%	SDA	%	X
0	0	0	0	2	10	14	70	4	20	1.9

Question 4: Do you feel that the Virginia's Standards of Learning as applied to academic course competencies should also be applied to technology education course competencies?

Table 4 provides an analysis of the responses to this question. Three (15%) of those that responded Strongly Agreed, 7 (35%) Agreed, 4 (20%) were Uncertain, 5 (25%) disagreed, and 1(5%) Strongly Disagreed. The mean calculated was 3.3, which indicates that the target population is uncertain about how they feel about Virginia's Standards of Learning as applied to technology education course competencies.

Table 4. Question 4 Statistical Analysis

SA	%	A	%	UNC	%	DA	%	SDA	%	X
3	15	7	35	4	20	5	25	1	5	3.3

Question 5: Do you feel that technology education course competencies should support and reinforce academic course competencies when related?

Table 5 provides a breakdown of the responses to this question. Nine (45%) of those that responded Strongly Agreed, and 11(55%) Agreed. With the mean calculated to be 4.95, this indicates that the population strongly agrees that technology education course competencies should support and reinforce academic course competencies when integrated through instructions.

Table 5. Question 5 Statistical Analysis

SA	%	A	%	UNC	%	DA	%	SDA	%	X
9	45	11	55	0	0	0	0	0	0	4.95

Question 6: I am familiar with the publication "*Technology Education Course Competencies with Related Academic Standards of Learning*" published by the Commonwealth of Virginia.

Table 6 provides a breakdown of the responses to this question. Eight (40%) of those that responded Strongly Agreed, 7 (35%) Agreed, 0 was Uncertain, 4 (20%) Disagreed, and 1 (5%) Strongly Disagreed. The mean calculated was 3.85, which indicates that the target population is familiar with the publication "*Technology Education Course Competencies with Related Academic Standards of Learning*" published by the Commonwealth of Virginia.

Table 6. Question 6 Statistical Analysis

SA	%	A	%	UNC	%	DA	%	SDA	%	X
8	40	7	35	0	0	4	20	1	5	3.85

Question 7: Do you use the document and agree with how it used technology education to reinforce academic competencies?

Table 7 provides a breakdown of the responses to this question. Eight (40%) of those that responded Strongly agreed, 7 (35%) Agreed, 0 was Uncertain, 4 (20%) Disagreed and 1 (5%) Strongly Disagreed. The mean calculated was 3.85, which indicates that the target population uses the document and agrees with how it used technology education to reinforce academic competencies.

Table 7. Question 7 Statistical Analysis

SA	%	A	%	UNC	%	DA	%	SDA	%	X
8	40	7	35	0	0	4	20	1	5	3.85

Question 8: Do you support a regional conference of technology educators to discuss technology's role on improving or reinforcing Virginia's Standard of Learning requirements?

Table 8 provides an analysis of the responses to this question. Eight (40%) of those that responded Strongly Agreed and seven (35%) Agreed. Three (15 %) were Uncertain. Two (10%) disagreed with no one Strongly Disagreeing. The mean calculated was 4.05 which indicates that the target population supports a regional conference of technology educators to discuss technology's role on improving or reinforcing Virginia's Standard of Learning requirements.

Table 8. Question 8 Statistical Analysis

SA	%	A	%	UNC	%	DA	%	SDA	%	X
8	40	7	35	3	15	2	10	0	0	4.05

Summary

In Chapter IV, the researcher presented and explained the data obtained from the survey. Tables were used which displayed responses in percentages and the statistical mean. Detailed analysis of the data collected from the responses provided by members of the Virginia Technologies Education Association were provided. In Chapter V the researcher will provide an overall summary of this study, his conclusions and his recommendations.

CHAPTER V

SUMMARY, CONCLUSION AND RECOMMENDATIONS

This chapter summarizes the information provided in the previous four chapters. The conclusions along with the recommendations provided in this chapter are based on the information collected and displayed in Chapter IV.

SUMMARY

The Standards of Learning are virtually the driving force behind education in Virginia today. Their successful implementation is most critical to each and every school system and is paramount to our children receiving a quality education. The awesome task of incorporating these standards and reinforcing the course competencies can not be understated. Our school system officials, administrators, principals, teachers and students are reminded daily of the significance of these standards.

There have been numerous studies conducted and programs put in place that allow for the improvement of the SOL scores. Studies such as the one carried out by Dr. Arvid Van Dyke, and his teams of Virginia technology educators, have proven that there are indeed technological programs which can support the SOL core courses competencies. Their analysis of 24 courses that reinforce the Standards of Learning has resulted in the publishing of the "*Technology Education Course Competencies with Related Academic Standards of Learning*".

Knowing that the Standards of Learning core competencies can be supported with technology education courses, the following questions need to be answered.

Are technology educators willing to use the information provided by the competency manual in their classrooms? Secondly, are they willing to review their own courses to determine other competencies that would support or enhance required Standards of Learning? Thirdly, would technology educators be willing to meet as a group to discuss methods and procedures that would enhance regional efforts to reinforce the standards of learning with technology course competencies? The study focused on the willingness of technology educators to provide answers to a survey on these questions and respond via the world wide web. This gave the target population the choice to participate or not and by responding demonstrates clearly the willingness of technology educators to get involved. Through these efforts the answers to the questions and the research goals has been determined.

CONCLUSIONS

The findings from this study were analyzed and compared to the goals established in Chapter 1 of this study:

1. Determine whether technology teachers were willing to establish a goal of improving SOL competency scores both locally and regionally. Question 1 was designed to determine how technology educators felt about Virginia stressing the academic core competencies in the Standards of Learning. By a review the responses, it was determined that at least one third of the target population had not formed an opinion about the Standards of Learning. Thirty-five percent of the respondents were undecided and with a mean of 3.4, it clearly indicates there is

need for further discussion within the profession. Question 8 addressed the willingness of the target population to meet and discuss the Standards of Learning. Forty percent Strongly Agree, thirty- five percent Agree, fifteen percent were Undecided and a mean of 4.05 was calculated. This clearly indicates that the teachers support and see the need for a regional conference to discuss technology education's role in support of the Standards of Learning.

By reviewing the responses to Questions 2 and 3, further insight can be gathered and a determination can be rendered with regard to technology teacher's willingness to restructure their courses to provide support and reinforce the academic competencies. Question 2 with 10 percent Strongly Agreeing, 60 percent Agreeing, and a mean of 3.5, clearly demonstrates that technology teachers feel that technology education should not stand-alone but should reinforce and support the Standards of Learning. This is supported by the responses to Question 3. Seventy percent of the respondents disagree, and 20 percent Strongly Disagree (mean of 1.9) with the concept of technology education standing alone. The survey shows there is significant support from technology teachers for reinforcement of the Standards of Learning

2. Determine if teachers' stress the competencies identified in *Technology Education Course Competencies Related to Academic Standards of Learning* publication in support of Standards of Learning objectives at their individual schools. A review of the responses to Questions 6 and 7, (answers were identical, 40 percent Strongly Agree, 35 percent Agree and a mean of 3.85) indicate that

technology teachers presently use the resource guide to reinforce/support academic course competencies within their own classrooms.

3. Make recommendations on how teachers can better support the teaching of academic SOL through technology education. Clearly the majority (75 percent) of the educators surveyed are using the *Technology Education Course Competencies to Related Academic Standards of Learning* publication. These professionals have researched, developed, tested and put to use methods and procedures that are producing positive results. If teachers are achieving positive results in individual classrooms, then the question needs to be asked, what kind of results could be achieved if these programs where established on a much broader scale and technology cooperatively worked together in supporting the Standards of Learning?

Recommendations

Based upon the findings and conclusions of this study, the researcher recommends the following:

1. All technology education teachers should review the *Technology Education Course Competencies to Related Academic Standards of Learning* publication and determine where they can individually support the core course competencies. If their course is not listed in the resource guide, then they should review their curriculums to determine where they can support the Standards of Learning.

2. Regional conferences should be scheduled which would include members

from the Virginia Technology Education Association and other technology teachers. The topics for these meetings should include methods and procedures that could increase technology education's reinforcement and support of the Standards of Learning.

3. The creation of a state-wide data base which contains information of educational programs, both academic- and technology- base, that have been proven effective in supporting of the Standards of Learning.

4. Offer Standards of Learning workshops at the Virginia Technology Education Association summer conference on achieving Virginia's Standards of Learning.

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Appendix A

Related Academic Standards of Learning for the Middle School Program in Technology Education (Grades 6-8)

Instruction in the Middle School Program incorporates and reinforces mathematics, science, English, history and social science, and computer/technology standards of learning (SOLs) as described in the document Standards of Learning for Virginia Public Schools, June 1995.
Identified below are specific SOLs included in this program. *

Mathematics

6.1 The student will identify representations of a given percent and describe orally and in writing the equivalence relationship between fractions, decimals, and percents.

6.2 The student will describe and compare two sets of data using ratios and will use appropriate notations such as all, a to b, and a:b.

6.6 The student will

- solve problems that involve addition, subtraction, and/or multiplication with fractions and mixed numbers, with and without regrouping, that include like and unlike denominators of 12 or less and express their answers in simplest form; and
- find the quotient, given a dividend expressed as a decimal through thousandths and a divisor expressed as a decimal to thousandths with exactly one non-zero digit. For divisors with more than one non-zero digit, estimation and calculators will be use.

6.7 The student will use estimation strategies to solve multistep practical problems involving whole numbers, decimals, and fractions.

6.8 The student will solve multistep consumer application problems involving fractions and decimals and present data and conclusions in paragraphs, tables, or graphs.

6.9 **The student will compare and convert units of measures for length, weight/ mass, and volume within the U.S. Customary system and within the metric system and estimate conversions between units in each system:**

- length-part of an inch (112, 1/4, and 1/8), inches, feet, yards, miles, millimeters, centimeters, meters, and kilometers;
- weight/mass-ounces, pounds, tons, grams, and kilograms;
- liquid volume-cups, pints, quarts, gallons, milliliters, and liters; and area-square units.

The intent of this standard is for students to make "ballpark" comparisons and not to memorize conversion factors between U.S. and metric units.

6.10 The student will estimate and then determine length, weight/mass, area, and liquid volume/capacity, using standard and nonstandard units of measure.

6.13 The student will estimate angle measures using 450,900 and 1800 as referents and use the appropriate tools to measure the given angle.

7.1 The student will compare, order, and determine equivalent relationships between fractions, decimals, and percents, including scientific notation.

* Academic SOLs are an essential component of Technology Education and are required to be successful in an educational field. The identification of related academic SOLs that are reinforced through application in technology courses supports and enhances academic instruction.

7.5.1 The student will solve consumer application problems involving tips, discounts, sales tax, and simple interest, using whole numbers, fractions, decimals, and percent.

8.1 The student will create and solve problems using proportions, formulas, and functions.

For Computer/Technology Standards of Learning, see page 17.

Science

6.1 **The student will plan and conduct investigations in which**

- observations are made involving fine discrimination between similar objects and organisms;
- a classification system is developed based on multiple attributes;
- differences in descriptions and working definitions are made;
- precise and approximate measures are recorded;
- scale models are used to estimate distance, volume, and quantity;
- hypotheses are stated in ways that identify the independent (manipulated) and dependent (responding) variables;
- a method is devised to test the validity of predictions and inferences;
- one variable is manipulated over time with many repeated trials;
- data are collected, recorded, analyzed, and reported using appropriate metric measurement;
- data are organized and communicated through graphical representation (graphs, charts, and diagrams); and
- models are designed to explain a sequence.

6.2 The student will demonstrate scientific reasoning and logic. Key concepts include

- ideas are investigated by asking for and actively seeking information;
- multiple tests of ideas are performed before accepting or rejecting them;
- alternative scientific explanations are analyzed; and

- conclusions are based on scientific evidence obtained from a variety of sources.

6.3 The student will investigate and understand sources of energy and their transformations. Key concepts include

- potential and kinetic energy;
- energy sources (fossil fuels, wood, wind, water, solar, and nuclear power); and energy transformations (mechanical to electrical, electrical to heat/light, chemical to light, and chemical to electrical/light).

6.4 The student will investigate and understand basic characteristics of electricity. Key concepts include

- electrical energy can be produced from a variety of energy sources and can he transformed into almost any other form of energy;
- electricity is related to magnetism;
- currents are either alternating or direct;
- circuits can be parallel or series;
- electrical energy can be described in volts and amps; and
- electrical energy consumption is measured using common units (kilowatts/kilowatt hours).

6.5 The student will investigate and understand that all matter is made up of atoms.

Key concepts include

- atoms are made up of electrons, protons, and neutrons;
- atoms of any element are alike but are different from atoms of other elements; and
- historical development and significance of discoveries related to the atom.

6.10 The student will investigate and understand the organization of the solar system and the relationships among the various bodies that comprise it. Key concepts include

- the sun, moon, Earth, other planets and their moons, meteors, asteroids, and comets;
- relative size of and distance between planets;
- the role of gravity;
- revolution and rotation;
- the mechanics of day and night and phases of the moon;
- the relationship of the Earth's tilt and seasons;
- the cause of tides; and
- the history and technology of space exploration.

6.11 The student will investigate and understand public policy decisions relating to the environment. Key concepts include

- management of renewable resources (water, air, plant life, animal life);

- management of nonrenewable resources (coal, oil, natural gas, nuclear power); and
- cost(benefit tradeoffs in conservation policies.

LS.1 The student will plan and conduct investigations in which

- data are organized into tables showing repeated trials and means;
- variables are defined;
- SI (metric) units are used;
- criteria are established for evaluating a prediction;
- models are constructed to illustrate and explain phenomena;
- sources of experimental error are identified;
- dependent variables, independent variables, and constants are identified;
- variables are controlled to test hypotheses and trials are repeated;
- continuous line graphs are constructed, interpreted, and used to make predictions; and
- interpretations from the same set of data are evaluated and defended.

LS.8 The student will investigate and understand that interactions exist among members of a population. Key concepts include

- competition, cooperation, social hierarchy, territorial imperative; and
- influence of behavior on population interactions.

PS.1 The student will plan and conduct investigations in which

- length, mass, volume, density, temperature, weight, and force are accurately measured and reported using the International System of Units (SI - metric);
- triple beam and electronic balances, thermometers, metric rulers, graduated cylinders, and spring scales are used to gather data;
- data from experiments are recorded and interpreted from bar, line, and circle graphs;
- research skills are utilized using a variety of resources;
- independent and dependent variables, constants, controls, and repeated trials are identified;
- valid conclusions are made after analyzing data;
- research methods are used to investigate practical problems, questions; and
- experimental results are presented in appropriate written form.

PS.5 The student will investigate and understand changes in matter and the relationship of these changes to the Law of Conservation of Matter and Energy. Key concepts include

- physical changes (effect of temperature on state, particle size on solubility, and temperature on solubility);
- nuclear reactions (products of fusion and fission and their effects on human beings and the environment); and

- chemical changes (types of reactions, reactants and products, and balanced equations).

PS.6 The student will investigate and understand states and forms of energy and how energy is transferred and transformed. Key concepts include

- potential and kinetic energy;
- mechanical, chemical, and electrical energy; and
- heat, light, and sound.

PS.7 The student will investigate and understand temperature scales, heat, and heat transfer. Key concepts include

- absolute zero, phase change, freezing point, melting point, boiling point, conduction, convection, radiation, vaporization, and condensation; and
- applications of heat transfer (heat engines, thermostats, and refrigeration).

PS.8 The student will investigate and understand characteristics of sound and technological applications of sound waves. Key concepts include

- wave length, frequency, amplitude, interference; and
- technological applications of sound.

Ps.9 The student will investigate and understand the nature and Technological applications of light. Key concepts include

- reflection, refraction, particle theory, wave theory; and
- electromagnetic spectrum.

PS.1O The student will investigate and understand scientific principles and technological applications of work, force, and motion. Key concepts include

- work, force, mechanical advantage, efficiency, power, horsepower, gravitational force, speed/velocity, mass/weight, Newton's three laws of motion, acceleration; and
- applications (simple machines, compound machines, powered vehicles, rockets, restraining devices, projectiles).

PS.11 The student will investigate and understand basic principles of electricity and magnetism. Key concepts include

- static, current, circuits; and
- magnetic fields and electromagnets.

For Computer/Technology Standards of Learning, see page 17.

English

6.1 The student will analyze oral participation in small-group activities.

- Communicate as leader and contributor.

- Evaluate own contributions to discussions.
- Summarize and evaluate group activities.
- Analyze the effectiveness of participant interactions.

6.2 The student will listen critically and express opinions in oral presentations.

- Distinguish between facts and opinions.
- Compare and contrast points of view.
- Present a convincing argument

6.3 The student will read and learn the meanings of unfamiliar words.

- Use knowledge of word origins and derivations.
- Use word-reference materials

6.5 The student will demonstrate comprehension of a variety of selections.

- Identify questions to be answered.
- Make, confirm, or revise predictions as needed.
- Use context clues to read unfamiliar words.
- Draw conclusions and make inferences based on explicit and implied information.
- Organize information for use in written and oral presentations.
- Compare and contrast information about one topic contained in different selections.

6.7 The student will write narratives, descriptions, and explanations.

- Use a variety of planning strategies to generate and organize ideas.
- Establish central idea, organization, elaboration, and unity.
- Select vocabulary and information to enhance the central idea, tone, and voice.
- Expand and embed ideas by using modifiers, standard coordination, and subordination in complete sentences.
- Revise writing for clarity.
- Edit final copies for correct use of language: subject-verb and pronoun-antecedent agreement, consistent tense inflections, and adverb and adjective usage.
- Edit final copies for writing mechanics: format, capitalization, punctuation, and spelling.

6.8 The student will use writing as a tool for learning in all subjects.

- Make lists.
- Paraphrase what is heard or read.
- Summarize what is heard or read.
- Hypothesize.
- Connect knowledge within and across disciplines.

- Synthesize information to construct new concepts.

6.9 The student will select the best sources for a given purpose, including atlases, dictionaries, globes, interviews, telephone directories, encyclopedias, electronic databases, and the *Reader's Guide.*

7.1 The student will give and seek information in conversations and in group discussions.

- Use oral vocabulary and style appropriate for listeners.
- Communicate ideas and information orally in an organized and succinct manner.
- Ask probing questions to seek elaboration and clarification of ideas.
- Make supportive statements to communicate agreement or acceptance of others' ideas.

7.2 The student will identify the relationship between a speaker's verbal and nonverbal messages.

- Use verbal communication skills, such as word choice, pitch, feeling, tone, and voice.
- Use nonverbal communication skills, such as eye contact, posture, and gestures.
- Compare/contrast a speaker's verbal and nonverbal messages..

7.3 The student will identify persuasive messages in nonprint media, including television, radio, and films.

- Identify persuasive technique used.
- Distinguish between fact and opinion

7.6 The student will read and understand information from varied sources.

- Use knowledge of text structures to aid comprehension.
- Make, confirm, or revise predictions as needed.
- Distinguish fact from Opinion in newspapers, magazines, and other print media.
- Summarize what is read.
- Organize and synthesize information for use in written and oral presentations.

7.8.1 The student will develop narrative, expository, persuasive, and technical writings.

- Apply knowledge of prewriting Strategies.
- Elaborate the central idea in an organized manner.
- Choose vocabulary and information that will cause a reader to perceive images and tone.
- Use clauses and phrases to embed context into sentences.
- Revise writing for Clarity.

- Edit final copies to ensure correct use of homonyms, pronoun-antecedent agreement, subject-verb agreement, and verb tense consistency.
- Edit final copies to ensure correct spelling, capitalization, punctuation, and format.
- Use available technology.

7.9 The student will use a word processor to plan, draft, revise, and publish some writings.

8.1 Use available word processing tools to check spelling, style, and grammar.

- Prepare and ask relevant questions for the interview.
- Make notes of responses.
- Compile and report responses.
- Evaluate the effectiveness of the interview.

8.4 The student will comprehend what is read from a variety of sources.

- Draw on background knowledge and knowledge of text structure to understand selections.
- Analyze details for relevance and accuracy.
- Read and follow instructions to assemble a model or simple structure.
- Evaluate and synthesize information to apply in written and oral presentations.

8.5 The student will write in a variety of forms, including narrative, expository and persuasive writings.

- Use prewriting strategies to generate and organize ideas.
- Focus on elaboration and organization.
- Select specific vocabulary and information.
- Use standard sentence formation, eliminating comma splices and other nonstandard forms of sentences that distract readers.
- Revise writing for word choice, appropriate organization, consistent point of view, and transitions among paragraphs.
- Edit final copies to ensure correct use of pronoun case, verb tense inflections, and adjective and adverb comparisons.
- Edit final copies to ensure correct spelling, capitalization, punctuation, and format.
- Use available technology.

8.6 **The student will analyze mass media messages.**

- Identify the persuasive technique being used.
- Describe the possible cause-effect relationships between mass media coverage and public opinion trends.
- Evaluate advertisements, editorials, and feature stories for relationships between intent and factual content.

For Computer/Technology Standards of learning, see page 17.

History and Social Science

6.5 The student will describe the economic, social, and political transformation of the United States since World War II, with emphasis on

- integration, desegregation, and the Civil Rights Movement;
- the changing role of women in America;
- the technology revolution and its impact on communication, transportation, and new industries;
- the consumer economy and increasing global markets;
- increases in violent crime and illegal drugs;
- effects of increased immigration;
- the impact of governmental social and economic programs and the Cold War on the growth of federal income tax revenues and government spending and the role of the Federal Reserve System;
- effects of organized religious activism; and
- political leaders of the period, trends in national elections, and differences between the two major political parties.

Computer/Technology

C/T8.1 The student will communicate through application software.

- Compose and edit a multipage document at the keyboard, using word processing skills and the writing process steps.
- Communicate with spreadsheets by entering data and setting up formulas, analyzing data, and creating graphs or charts to visually represent data.
- Communicate with databases by defining fields and entering data, sorting, and producing reports in various forms.
- Use advanced publishing software, graphics programs, and scanners to produce page layouts.
- Integrate databases, graphics, and spreadsheets into word-processed documents.

C/T8.2 The student will communicate through networks and telecommunication.

- Use local and worldwide network communication systems.
- Develop hypermedia "home page" documents that can be accessed by worldwide networks.

C/T8.3 The student will have a basic understanding of computer processing, storing, retrieval, and transmission technologies and a practical appreciation of the relevant advantages and disadvantages of various processing, storage, retrieval, and transmission technologies.

C/T8.4 The student will process, store, retrieve, and transmit electronic information.

- Use search strategies to retrieve electronic information.
- Use electronic encyclopedias, almanacs, indexes, and catalogs to retrieve

and select relevant information.

- Use laser discs with a computer in an interactive mode.
- Use local and wide-area networks and modem-delivered services to access and retrieve information from electronic databases.
- Use databases to perform research.

Appendix B

Dear Technology Educator:

I am conducting research on the willingness of technology teachers to support the Standards of Learning (SOL) objectives. I request your assistance and ask you to provide the data I need to support this study. The attached file is a survey that will greatly assist me in my research. Your participation is crucial to the success of this research. You are the front line troops and your experience and expertise in technology education is the key to the success of this study.

Please, read the survey, respond to the statements and return it to me via e-mail to lambjw@ AOL.com by 25 November 1999. Your assistance is greatly appreciated. Thank you for your valuable time.
Sincerely,
James W. Lambert.

The Relationships of Technology Education and the Standards of Learning Survey.

Purpose:

1. To determine the willingness of technology educators to establish goals for improving the Standards of Learning competency scores both locally and regionally.
2. Determine if technology educators stress the competencies identified in the "Technology Education Course Competencies to Related Academic Standards of Learning Manual" in support of the program objectives at their respective schools.

Direction: Read each statement and provide a response, which represents your position on articulating the Standards of Learning through Technology Education. Once you have completed the survey, e-mail the results to LambJW@aol.com. No names or e-mail addresses will be published in this research project and any comments or recommendations you wish to share will be held in confidence.

SURVEY QUESTIONS

1. How do you feel about Virginia's Standard of Learning stressing academic competencies?

   Strongly Agree____ Agree____ Uncertain____ Disagree____ Strongly Disagree____

2. Do you feel that technology education teachers should structure their courses to reinforce the academic competencies?

   Strongly Agree____ Agree____ Uncertain____ Disagree____ Strongly Disagree____

3. Do you feel that the technology education curriculum should stand-alone and not contribute to student's achievement of academic competencies?

   Strongly Agree____ Agree____ Uncertain____ Disagree____ Strongly Disagree____

4. Do you feel that the Virginia's Standards of Learning (SOL) as applied to academic course competencies should also be applied to technology education course competencies?

   Strongly Agree____ Agree____ Uncertain____ Disagree____ Strongly Disagree____

5. Do you feel that technology education course competencies should support and reinforce academic course competencies when related?

   Strongly Agree____ Agree____ Uncertain____ Disagree____ Strongly Disagree____

6. Do you feel that Virginia's educators should make Academic Standards of Learning the primary focus of the education system or should technology teachers continue to evolve course curriculums to meet the needs of a technological society?

   Strongly Agree____ Agree____ Uncertain____ Disagree____ Strongly Disagree____

7. I am familiar with the publication "Technology Education Course Competencies with Related Academic Standards of Learning Manual" published by the Commonwealth of Virginia.

   Strongly Agree____ Agree____ Uncertain____ Disagree____ Strongly Disagree____

8. Do you use the document and agree with how it used technology education to reinforce academic competencies?

   I use it ___ I have reviewed it____ I am familiar with it ____ I am not familiar with it____

9. Do you support a regional conference of technology educators to discuss technology's role on improving or reinforcing Virginia's Standard of Learning requirements?

   Strongly Agree____ Agree____ Uncertain____ Disagree____ Strongly Disagree____

Recommendations and Comments: Please provides any comments or recommendations regarding the relationship of the Standards of Learning and Technology Education that you think are important.