1991

The Implementation of "LAB 2000" and "Synergistic Systems" in Middle School Laboratories in Virginia

Patricia M. Ways
Old Dominion University

THE IMPLEMENTATION OF "LAB 2000" AND "SYNERGISTIC SYSTEMS" IN MIDDLE SCHOOL LABORATORIES IN VIRGINIA

A Research Paper

Presented to the Faculty of

The Occupational and Technical Studies Department

Old Dominion University

In Partial Fulfillment

of the Requirements for the Degree

Master of Science in Secondary Education

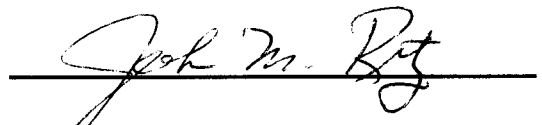
By

Patricia M. Ways

July, 1991

This research paper was prepared under the direction of Dr. John M. Ritz, Graduate Advisor. It is submitted to the Graduate Program Director in partial fulfillment of the requirement for the Degree of Master of Science in Secondary Education.

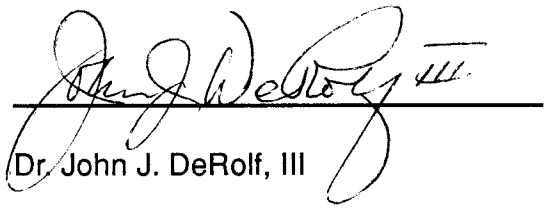
Approved by



Dr. John M. Ritz

Graduate Advisor

Date 3-15-91



Dr. John J. DeRolf, III

Graduate Program Director

Occupational and Technical Studies

Date 8/20/91

TABLE OF CONTENTS

TABLE OF TABLES

CHAPTER I

INTRODUCTION

The stated purpose of the new Virginia middle school curriculum guides is to improve the quality of the critical thinking skills and problem solving skills of our students in technology education courses. The intention was to accomplish this at three different levels with courses titled "Introduction to Technology - Grade 6", "Inventions and Innovations - Grade 7", and "Technological Systems - Grade 8" (Technology Education Service, Virginia Department of Education, 1988, p. 7).

Suppliers of Technology Education equipment have developed specific laboratories designed to enable experimentation of concepts with equipment scaled down to a reasonable price for the school laboratory. The two most innovative systems on the market in Virginia are Creative Learning Systems "Lab 2000" and Synergistics Technology Systems, Inc. "Synergistic Systems". The State of Virginia has helped to install thirteen of the former and twelve of the latter in middle school laboratories.

Statement of Problem

The problem of this study was to determine if the "High-Tech Laboratories" installed in middle schools in the state of Virginia met the needs of the teachers while implementing the state middle school technology education curriculum goals.

Research Goals

To solve this problem, the following goals were developed:

1. Determine the effectiveness of the "high tech" laboratories with regard to implementing the middle school curriculum.
2. Make recommendations for facility and curriculum changes based upon the observations of the practicing middle school teachers.

Background and Significance

The Virginia Department of Education has assisted financially, as well as, with many hours in researching the best approach to meet the goals of their middle school curriculum. Their opinion is that the laboratories provide a learning environment where more advanced work can be done with computers and high-tech devices. They also felt the innovative laboratories presented an entirely different image to students, administrators and parents from the traditional technology laboratories (Hughes, Virginia Department of Education, 1991). Universities have invested research time and dollars to determine the best method of reaching these goals in order to train future educators. Some local school divisions have invested in partial to full laboratories to test their ability to meet these same goals. Some localities have combined portions of the different laboratories with existing setups. Before further money is put forth, especially in local districts, more feedback is needed to determine the best route to take in laboratory design to meet the goals

and competencies of the middle school technology curriculum.

The "High-Tech Laboratories" have only recently been installed in many locations and only a small number have been in place for a period of two to three years. Thus far, the Virginia Department of Education is of the opinion that the Lab 2000 more closely meets the needs of the middle school technology education curriculum. It has more potential for modification, although both have been adapted and updated since the inception of the original models (Hughes, Virginia Department of Education, 1991).

Limitations

This study was limited in the following manner:

1. The number of teachers presently using the two stated laboratories were limited to fourteen for the "Lab 2000" and twenty-one for the "Synergistic Systems".

2. The time period in which some of the teachers have used the laboratories was limited to six to eight months, whereas others have been in use for three years.

3. The socio-economic background of the students differed in the particular middle schools containing the laboratories.

4. The educational and technological background of the middle school teachers varied.

5. The study was also limited to achieving the middle school technology education goals and competencies.

Basic Assumptions

This study assumed that:

1. The "High-Tech Laboratories" did in fact meet the goals and competencies of the state curriculum guide due to the flexibility of their use.
2. Teachers were using the middle school technology education curriculum guides.
3. The new middle school curriculum materials were compatible to the Lab 2000 and Synergistic Lab.

Procedures

The list of teachers with the "High-Tech Laboratories" in place was obtained from the State Department of Education of Virginia. A survey was mailed that contained all of the curriculum goals for the Technology Education Curriculum, Introduction to Technology Curriculum, Inventions and Innovations Curriculum, and Technological Systems Curriculum. The participants were asked if the "high tech" labs enabled them to meet the goals of each of these curriculums. Data was compiled by using the Likert Scale of five points, strongly agree to strongly disagree.

Definition of Terms

The following definitions should be applied when reading this research paper:

"High-Tech Laboratories"..... Specific laboratories designed and manufactured by individuals in industry catering to the area of Technology Education.

Middle School..... A school curriculum for grades six through eight containing classes in the exploratory mode in order to assess interest in particular job training or college preparatory work.

Technology Education..... The school discipline for the study of the application of knowledge, creativity, and resources to solve problems and extend human potential (Technology Education for the 21st Century Questions and Answers, 1988, p.1).

Synergistic Systems..... A lab developed by Synergistics Systems, marketed by Pitsco, with a module learning approach and team teaching.

Lab 2000..... A lab developed by Jim Durkin of

	TransTech Systems of San Diego, Ca, marketed by Creative Learning Systems, with a system of islands, computer networking, simulations, testing facilities and modeling.
Goals	The end purpose of the curriculum.
Competencies.....	The abilities the students should have upon completion of a technology education course.

Overview of Chapters

Chapter I dealt with the purpose of the Middle School Technology Education curriculum and the laboratories designed to meet its stated goals and competencies. The problem was stated, limitations were stated, assumptions were made, and procedures were explained.

Chapter II will review literature in regard to "High-Tech Laboratories" and the middle school curriculum. Chapter III will contain detailed procedures for undertaking this study. Chapter IV will contain findings and Chapter V will provide the summary, conclusions and recommendations.

CHAPTER II

REVIEW OF LITERATURE

Chapter II of this study reviewed information about the laboratories used in the new Virginia middle school programs. The information was taken from the viewpoints and experiences of the instructors in the Lab 2000 in Butler Middle School, Salt Lake City, Utah, the Synergistics Lab in Pittsburg Middle School, Pittsburg, Kansas, and the supervisor for Delta County, Colorado who helped start the Synergistics Lab at Pittsburg Middle School and went on to establish programs in Colorado.

Creative Learning Systems Lab 2000

The "Lab 2000" was developed by James Durkin of TransTech Systems in San Diego, California and is marketed by Creative Learning Systems. Kim Durfee of Butler Middle School in Salt Lake City, Utah, was one of the first to use this laboratory configuration.

The Lab 2000 consists of four technology islands, a fabrication center, a hydroponic greenhouse area and an experimental structures zone. Each technology island contains three work/learn stations arranged in a triangle around a pylon. The pylon contains conduit for computer networking and power panels. The individual station could be a modeling station or a computer console. The islands can be rearranged by the instructor. The students work in teams of two, with six

students per island. If there is an overflow of students, they work in the fabrication, hydroponic and experimental structure areas (Durfee, 1988, p. 41).

The laboratory comes equipped with learning modules (packets) that contain base information, instruction and activities to be performed. The information the students learn applies to many areas of the Utah middle school curriculum, therefore, they will encounter information in more than one phase of their learning. For example, the use of lasers, basic wiring of circuits and computer techniques evolve into activities where computers control or automate devices they have built.

There are many activities occurring in the Lab 2000 at the same time. Some of the activities include:

1) use of a Macintosh computer and word processing program to make signs,

2) computer-aided drawing to draw parts of the lab,

3) fabrication techniques to make display modules for their work,

4) modular building to construct tabletop models of gear trains, ferris wheels, elevators and traffic lights (programmed and controlled by the computer),

5) use of built-in supplies of air and low-voltage electricity to study electronic and pneumatic devices,

6) hand-manipulated robots to programmable robotic constructions,

7) experimentation with lasers to detect interference in sound reception, fiber optic application and satellite simulations,

8) rocket thrust testing,

9) solar energy experiments,

10) a computer-based flight simulation program,

11) a wind-tunnel for testing aerodynamic performance of models,

12) hydroponic greenhouses,

13) digitizing equipment, and

14) a complete video production and editing system.

An emphasis to this approach to learning is responsibility. Students must maintain notebooks to demonstrate what they have accomplished. Originally there was concern as to whether or not the students would keep their notebooks as instructed. Not only were they doing so, but to a degree that impressed the teacher. Therefore, these notebooks have become the major basis for grading (Durfee, 1988, p. 42).

The concept of teamwork was important for the students to learn to work with others. The idea of placing students with lesser ability with those of more advanced ability to compliment each other was stressed by the teacher (Durfee, 1988, p. 42).

The implementation of the Lab 2000 in the classroom was important in the aspect of behavior also. The students time was consumed with working properly through the system and this helped to eliminate some discipline problems. Another factor was the newness of the facilities and concepts (Durfee, 1988, p. 42).

To show the success of the Lab 2000, an update was written to show some of the activities that have evolved as a result of their experiences. Students in a Lab 2000 at Butler Middle School undertook the development of a student database. A

student took a leadership role, assessed the talent of his classmates, assigned tasks and created a HyperCard stack for use by future students (Durfee, 1991, p. 38). Another student at Butler Middle School constructed a dexterous robotic hand that was able to pick up several items, including a glass of water (Durfee, 1991, p. 38).

Pitsco's Synergistics Lab

In the Fall of 1986, the Synergistics Technology Systems, Inc., "Synergistic Systems," marketed by Pitsco, was implemented in the Pittsburg Middle School in Pittsburg, Kansas (Neden, Iley and Winchester, 1988, p. 23). Since that time labs of this nature have been installed in many school systems and universities. Mike Neden of the original Pittsburg, Kansas group moved on to begin programs in Delta County, Colorado.

The original setup was designed for seventh and eighth grade students in an Explorations in Technology program. Since that time an addition was made for sixth grade students in an Introduction to Technology program. This compares to the Virginia curriculum in that the recommended curriculum has sixth graders going through an Introduction to Technology program, seventh grade students through Inventions and Innovations, and eight grade students through Exploring Technological Systems.

The Synergistics Lab for Exploration in Technology was configured for 36

students per hour to explore 18 different technology modules. The students enrolled in the class for three semesters, allowing them to work through six different module areas each semester (Neden, Iley and Winchester, 1988, p. 23). Twenty-four module workstations were designed for this program with three instructors team-teaching. The original modules included Electricity/Electronics; Drawing, Drafting and Design; Applied Physics; Automobile Engine Systems; Small Gas Engines; Performance Vehicles; Research and Design; Computer Applications; Think Tank; Rocketry and Spaceflight; Production Technology; Computer Numerical Control; Transportation; Robotics; Flight Technology; Future Technology; Desktop Publications; and Radio/Communications. Interest and enthusiasm from the students and parents made it necessary to expand the modules and offerings to include Television/Video Lab - Production, Television/Video Lab - Camera, Television/Video Lab - Programming, Problem Solving Techniques, Structures Technology, and Computer Systems Module (Neden, Iley and Winchester, 1988, p. 25).

Because of the many different activities that needed to be covered at the same time, a self-paced teaching system was developed that placed the responsibility for learning directly on the students. They were responsible for vocabulary words, study questions, and pre- and post-test scores for each module. Students were placed in groups of two with ten days to work through a module. It was felt this was an appropriate time period for the attention span of the student. Everything the student needed was within the module so there was no need to leave the work area.

This assisted the teacher in alleviating discipline problems since there were so many activities going on at once. The facility was designed to be flexible so as to add, modify and delete areas as they became obsolete (Neden, Iley and Winchester, 1988, p. 25).

For the Introduction to Technology sixth grade program, all students rotated through 12 modules in one trimester. They included Introduction to Robotics, Introduction to Electricity, Introduction to Electricity/Electronics, Introduction to Graphic Communications, Introduction to Computers, Word Processing, Heavier than Air Flight, Hot Air Balloons, Material Fabrications, Measurement, Material Processing, Structures, and Creative Problem-Solving.

The management and teaching system used by the 6th grade Pittsburg, Kansas team was comparable to the systems used in the seventh and eighth grade program. A two-tiered carpeted area with tables, chairs and sound system called "Mission Control" was placed in one area for class and small group activities. There were three large "Space Stations" each containing four learning modules. Therefore, each space station was able to hold eight students with two students per workstation. The Space Stations were "X" shaped with call light systems to signal the instructor when help was needed. The space stations contained satellite units for storage and movement from one Space Station to another.

As Mike Neden, one of the original instructors at Pittsburg, Kansas, moved on to Delta County, Colorado, he was able to lay down the groundwork for his expectations of his new curriculum and facilities. His planning included student

responsibility for learning, knowledge based learning, and an interdisciplinary approach to learning. He wanted the lab to be cost effective and realistic, synergistic in nature, flexible and easily adaptable to change, and activity oriented. Other areas of importance were to be student-centered vs. teacher-centered, able to maximize the opportunities for students, ability to relate to previous education, and provide the best possible learning environment. It should also facilitate group and individual problem-solving situations, critical and analytical thinking and opportunities for interpersonal relationship development (Neden, 1990, p. 25).

Mike Neden's philosophy on technology is that we need to teach to the different levels of Bloom's Taxonomy. Our traditional programs emphasized facts and figures, but our students needed to be able to apply knowledge to different situations (Neden, 1990, p. 26). Too many programs also revolved around the idea that technology can be broken down into four groups: manufacturing, construction, communications and transportation. Many areas of technology overlap and we repeat information from one class to another. Mike Neden used laser technology as an example of this point. Laser technology was used in many different areas from electronics to communications to biotechnology. Through the use of modular learning, the students were introduced to the different concepts and equipment within one class, experimenting to their potential level and interest level. This reduced the need for so many different teachers and expensive laboratories.

Within the modular approach, the teacher learned to become a facilitator of knowledge instead of the authority. There was so much information and it was

impossible for one individual to know everything. Therefore, the teacher needed to have a base knowledge, to encourage student research and experimentation, and to learn from the students as they discovered new things (Neden, 1990, p. 26).

Important features of the labs should include everything from the call light system to signal a need for help (prevent students leaving the work station) to the color of the lab for a positive work environment. There is a need to make the student feel the lab is futuristic to motivate them for learning. The lab needs a notebook and student record system for accountability. Equipment storage should be in an open manner for easy access and accountability with a module configuration and appropriate wall height to allow maximum instructor supervision. There should be organized storage for instructions (to avoid searching each day for the correct manual) and labels for the workstations. Ample computers, TV/VCR viewing areas and tape storage areas are necessary for maximum time on task (Neden, 1990, p. 29).

As the high school curriculums are being written in many states to carry over the success of the middle school programs, interdisciplinary learning is highly stressed. There is a new wave of thought that the vocational areas are no longer satisfying the needs of this nation. Administrators in technology education in Colorado are trying to combat that idea and ensure their place in the new curriculum with the implementation of the Center for Applied Learning in Delta County which works on a similar basis to the middle school program (Neden, 1990, p. 28). The core classes are Applied Technology, Applied Math, Principles of Technology 1, Inter-Disciplinary

Learning Lab, Team Problem-Solving and Independent Studies. These classes stress interdisciplinary learning and the exploration of specific areas of interest to them. Some of their successes include the visitation of 3500 people in the 1989-1990 school year and a videotape "Delivering the Future" that has been presented nationally (Neden, 1990, p. 28).

Summary

According to the instructors presently using and writing about the labs, they are both an excellent base for teaching the new concepts of technology education. They stress the ideas of student responsibility, interdisciplinary learning, flexibility, student-centered learning, and development of problem solving ability and critical thinking skills. The enrollment has increased not only in the classroom but with parental involvement.

CHAPTER III

METHODS AND PROCEDURES

Chapter III will describe the methods and procedures used to undertake this study. Within this chapter will be a description of the populations, the research design and the method of collecting data.

Population

The population of this study consisted of 35 middle school technology education teachers in 24 labs within the state of Virginia. This was the complete population of teachers with a "high tech" laboratory in the state of Virginia at the time. It was possible to use the entire population because of the small number involved. Each of the participants had either the "Lab 2000" or "Synergistics Lab" in place in their middle school at the time of the study. According to the "Lab 2000" design, the teachers work by themselves, which is the case in most of the Virginia labs. Some of the teachers were working alone in the "Synergistics" approach and others were team-teaching according to the original design. There were 14 teachers in the 12 "Lab 2000" situations and 21 teachers in the 12 "Synergistics" laboratories.

Research Design

The method of research was a survey. A sample of the survey is included in Appendix A. The survey asked if the "high tech" laboratory in use enabled the instructor the achieve the goals of the middle school technology education programs according to the Virginia middle school technology education curriculum guides. These were answered according to the Likert Scale of 1 to 5, with 1 being "strongly disagree" to 5 being "strongly agree."

In addition, the teachers were asked which "high tech" laboratory they were using and the number of years they had been using the "high tech" lab. The total years using the "high tech" lab gave a better indication of their practical use of the lab.

Data Collection

The data was collected by mailing survey forms to the 35 individuals working in a setting with the "high tech" lab in place. The questionnaires were mailed on May 24, 1991 with a requested response date of June 7, 1991. A cover letter was sent explaining the purpose of the research. The letter stressed that school divisions planning to make purchases of either type of lab would like to know how effective the labs were from individuals practicing in them. A sample cover letter is inserted as Appendix B.

Upon receipt of the surveys, the number of responses were tallied as to whether

they felt the lab did or did not meet the goals of the curriculum. From there the mean was determined for each goal of the Technology Education Curriculum, Introduction to Technology Curriculum, Inventions and Innovations Curriculum and the Technological Systems Curriculum.

Summary

The methods and procedures for conducting this research were explained at the beginning of the chapter. The populations surveyed, the research design and the method of data collection were explained. The results of the survey will be tabulated and reported in Chapter IV.

CHAPTER IV

FINDINGS

Chapter IV will report the findings as to whether or not the goals of this study were being met. The problem of this study was to determine if the "High-Tech Laboratories" installed in middle school laboratories in the state of Virginia met the needs of the teachers while implementing the Virginia middle school technology education curriculum goals.

This chapter will disclose the data according to the responses to the survey. Seventy-one percent of the individuals that were mailed surveys responded. The remainder of the chapter is devoted to reporting the statistical analysis of the data acquired from the survey.

Curriculum Statistics

The surveys were sent to the 35 teachers in the state of Virginia presently teaching middle school with "high tech" laboratories in place. The surveys were mailed May 24, 1991 with the request to be returned by June 7, 1991. Of the 35 surveys mailed, 25 or 71 percent were returned.

Of the surveys returned, one instructor omitted 1 item out of 26 and another instructor omitted two sections or 14 out of 26 items. The sections omitted were done so because that particular teacher does not have the second (7th grade) and third (8th grade) levels of middle school classes in his lab. Therefore, 15 of the 312

responses for the Lab 2000 questionnaires were omitted. For the Synergistics Lab, all 338 items were completed.

Of the teachers responding to the survey, 12 out of 14 (or 80 percent) in the Lab 2000 responded, and 13 out of 21 (or 62 percent) in the Synergistics Lab responded. Of those teachers not responding to the survey, two were representative of a Lab 2000, and eight were representative of the Synergistics Lab. In the Synergistics Lab, some of the teachers worked together, therefore, only three labs were without representatives responding to the survey.

The results of the Lab 2000 and Synergistics Lab survey are located in Tables 1 through 4. They were categorized into tables according to the overall goals of Technology Education (Table 1), the Introduction to Technology (Table 2), Inventions and Innovations (Table 3) , and Technological Systems (Table 4). The tables were arranged with four main columns: Item No., Lab 2000, Synergistics Lab, and the Mean. The 26 items (or goals) were listed separately with the number of responses to each strongly disagree, disagree, no opinion, agree or strongly agree listed in columns beside the item. Beside the number is the percentage of respondents answering either strongly disagree, disagree, no opinion, agree or strongly agree to each item. The last column in each section indicates the mean score for that area (Lab 2000 or Synergistics Lab). The final column indicates the mean for both types of labs. In order to determine whether or not a goal was met by the "high tech" lab, a cut off of above 3.5 was used for having met and a cut off of below 2.5 for not having met the goal. The items between 2.5 and 3.5 fell in the no opinion range.

Technology Education Curriculum Goals

Item number one stated that the students will comprehend the dynamics of technology, including its development, impact and potential. According to the responses in the Lab 2000 situation, zero or zero percent responded strongly disagree and zero or zero percent responded disagree. In the no opinion category, one or 8.3 percent responded. Six or 50 percent responded agree and five or 41.6 percent responded strongly agree. This resulted in a mean of 4.33. In the Synergistic Lab situation, zero or zero percent responded strongly disagree and one or 7.7 percent responded disagree. In the no opinion category, zero or zero percent responded. Seven or 53.8 percent responded agree and five or 38.5 percent responded strongly agree. This resulted in a mean of 4.23. The overall mean for this item was 4.28. (See Table 1)

Item number two stated that the students will employ the technological processes of problem-solving, creating, and designing. According to the responses in the Lab 2000 situation, zero or zero percent responded strongly disagree and zero or zero percent responded disagree. In the no opinion category, zero or zero percent responded. Two or 16.6 percent responded agree and 10 or 83.3 percent responded strongly agree. This resulted in a mean of 4.83. In the Synergistic Lab situation, zero or zero percent responded strongly disagree and one or 7.7 percent responded disagree. In the no opinion category, zero or zero percent responded. Five or 38.5 percent responded agree and seven or 53.8 percent responded

Technology Education Goals																						
Curriculum Item No.	Lab 2000 Teachers											Synergistic Lab Teachers											
	SD		D		NO		A		SA		$\bar{x}$	SD		D		NO		A		SA		$\bar{x}$	$\bar{x}$
	No.	%	No.	%	No.	%	No.	%	No.	%		No.	%	No.	%	No.	%	No.	%	No.	%		
1. Comprehend the dynamics of technology, including its development, impact and potential.	0	0%	0	0%	1	8.3%	6	50%	5	41.6%	4.33	0	0%	1	7.7%	0	0%	7	53.8%	5	38.5%	4.23	4.28
2. Employ the technological processes of problem-solving, creating, and designing.	0	0%	0	0%	0	0%	2	16.6%	10	83.3%	4.83	0	0%	1	7.7%	0	0%	5	38.5%	7	53.8%	4.39	4.67
3. Analyze the behavior of technological systems and subsystems, including the tools, materials, processes, energy, information, and people involved in systems.	0	0%	1	8.3%	0	0%	8	66.7%	3	25%	4.08	0	0%	2	15.4%	2	15.4%	7	53.8%	2	15.4%	3.69	3.89
4. Apply scientific principles, engineering concepts, and technological systems in the processes of technology.	0	0%	0	0%	0	0%	3	25%	9	75%	4.75	0	0%	0	0%	0	0%	7	53.8%	6	46.2%	4.46	4.61
5. Discover and develop personal interests and abilities related to a wide variety of technology-oriented careers.	0	0%	0	0%	1	8.3%	1	8.3%	10	83.3%	4.75	0	0%	2	15.4%	0	0%	3	23.1%	8	61.5%	4.31	4.53

Table 1

strongly agree. This resulted in a mean of 4.39. The overall mean for this item was 4.67. (See Table 1)

Item number three stated that the students will analyze the behavior of technological systems and subsystems, including the tools, materials, processes, energy, information, and people involved in systems. According to the responses in the Lab 2000 situation, zero or zero percent responded strongly disagree and one or 8.3 percent responded disagree. In the no opinion category, zero or zero percent responded. Eight or 66.7 percent responded agree and three or 25 percent responded strongly agree. This resulted in a mean of 4.08. In the Synergistic Lab situation, zero or zero percent responded strongly disagree and two or 15.4 percent responded disagree. In the no opinion category, two or 15.4 percent responded. Seven or 53.8 percent responded agree and two or 15.4 percent responded strongly agree. This resulted in a mean of 3.69. The overall mean for this item was 3.89. (See Table 1)

Item number four stated that the students will apply scientific principles, engineering concepts, and technological systems in the processes of technology. According to the responses in the Lab 2000 situation, zero or zero percent responded strongly disagree and zero or zero percent responded disagree. In the no opinion category, zero or zero percent responded. Three or 25 percent responded agree and nine or 75 percent responded strongly agree. This resulted in a mean of 4.75. In the Synergistic Lab situation, zero or zero percent responded strongly disagree and zero or zero percent responded disagree. In the no opinion

category, zero or zero percent responded. Seven or 53.8 percent responded agree and six or 46.2 percent responded strongly agree. This resulted in a mean of 4.46. The overall mean for this item was 4.61. (See Table 1)

Item number five stated that the students will discover and develop personal interests and abilities related to a wide variety of technology-oriented careers. According to the responses in the Lab 2000 situation, zero or zero percent responded strongly disagree and zero or zero percent responded disagree. In the no opinion category, one or 8.3 percent responded. One or 8.3 percent responded agree and ten or 83.3 percent responded strongly agree. This resulted in a mean of 4.75. In the Synergistic Lab situation, zero or zero percent responded strongly disagree and two or 15.4 percent responded disagree. In the no opinion category, zero or zero percent responded. Three or 23.1 percent responded agree and eight or 61.5 percent responded strongly agree. This resulted in a mean of 4.31. The overall mean for this item was 4.53. (See Table 1)

Introduction to Technology Curriculum Goals

Item number six stated that the students will explore the elements, systems, and impact of technology. According to the responses in the Lab 2000 situation, zero or zero percent responded strongly disagree and zero or zero percent responded disagree. In the no opinion category, zero or zero percent responded. Nine or 75 percent responded agree and three or 25 percent responded strongly

Introduction to Technology Goals

Curriculum Item No.	Lab 2000 Teachers											Synergistic Lab Teachers											
	SD		D		NO		A		SA		$\bar{x}$	SD		D		NO		A		SA		$\bar{x}$	$\bar{x}$
	No.	%	No.	%	No.	%	No.	%	No.	%		No.	%	No.	%	No.	%	No.	%	No.	%		
6. Explore the elements, systems, and impact of technology.	0	0%	0	0%	0	0%	9	75%	3	25%	4.25	0	0%	0	0%	1	7.7%	7	53.8%	5	38.5%	4.31	4.28
7. Understand the interdisciplinary aspects of the study of technology.	0	0%	0	0%	0	0%	8	66.7%	4	33.3%	4.33	0	0%	1	7.7%	1	7.7%	8	61.5%	3	23.1%	4.00	4.17
8. To apply mathematics and science to the solution of problems.	0	0%	0	0%	0	0%	3	25%	9	75%	4.75	0	0%	0	0%	0	0%	8	61.5%	5	38.5%	4.39	4.57
9. Develop student interest in further study and application of technology.	0	0%	0	0%	1	8.3%	2	16.6%	9	75%	4.67	0	0%	0	0%	1	7.7%	5	38.5%	7	53.8%	4.46	4.57
10. Appreciate advances in high technology.	0	0%	0	0%	0	0%	2	16.6%	10	83.3%	4.83	0	0%	0	0%	2	15.4%	6	46.2%	5	38.5%	4.23	4.53
11. Motivate young women and men to consider careers in technology.	0	0%	0	0%	1	8.3%	6	50%	5	41.6%	4.33	0	0%	0	0%	1	7.7%	9	69.2%	3	23.1%	4.15	4.24
12. Utilize computers and other educational technology (plotters, video equipment, digitizers) to solve problems and understand technology.	0	0%	0	0%	0	0%	0	0%	12	100%	5	0	0%	0	0%	0	0%	4	30.8%	9	69.2%	4.69	4.85

Table 2

agree. This resulted in a mean of 4.25. In the Synergistic Lab situation, zero or zero percent responded strongly disagree and zero or zero percent responded disagree. In the no opinion category, one or 7.7 percent responded. Seven or 53.8 percent responded agree and five or 38.5 percent responded strongly agree. This resulted in a mean of 4.31. The overall mean for this item was 4.28. (See Table 2)

Item number seven stated that the students will understand the interdisciplinary aspects of the study of technology. According to the responses in the Lab 2000 situation, zero or zero percent responded strongly disagree and zero or zero percent responded disagree. In the no opinion category, zero or zero percent responded. Eight or 66.7 percent responded agree and four or 33.3 percent responded strongly agree. This resulted in a mean of 4.33. In the Synergistic Lab situation, zero or zero percent responded strongly disagree and one or 7.7 percent responded disagree. In the no opinion category, one or 7.7 percent responded. Eight or 61.5 percent responded agree and three or 23.1 percent responded strongly agree. This resulted in a mean of 4.00. The overall mean for this item was 4.17. (See Table 2)

Item number eight stated that the students will be able to apply mathematics and science to the solution of problems. According to the responses in the Lab 2000 situation, zero or zero percent responded strongly disagree and zero or zero percent responded disagree. In the no opinion category, zero or zero percent responded. Three or 25 percent responded agree and nine or 75 percent responded strongly agree. This resulted in a mean of 4.75. In the Synergistic Lab

situation, zero or zero percent responded strongly disagree and zero or zero percent responded disagree. In the no opinion category, zero or zero percent responded. Eight or 61.5 percent responded agree and five or 38.5 percent responded strongly agree. This resulted in a mean of 4.39. The overall mean for this item was 4.57. (See Table 2)

Item number nine stated that the students will develop interest in further study and application of technology. According to the responses in the Lab 2000 situation, zero or zero percent responded strongly disagree and zero or zero percent responded disagree. In the no opinion category, one or 8.3 percent responded. Two or 16.6 percent responded agree and nine or 75 percent responded strongly agree. This resulted in a mean of 4.67. In the Synergistic Lab situation, zero or zero percent responded strongly disagree and zero or zero percent responded disagree. In the no opinion category, one or 7.7 percent responded. Five or 38.5 percent responded agree and seven or 53.8 percent responded strongly agree. This resulted in a mean of 4.46. The overall mean for this item was 4.57. (See Table 2)

Item number ten stated that the students will appreciate advances in high technology. According to the responses in the Lab 2000 situation, zero or zero percent responded strongly disagree and zero or zero percent responded disagree. In the no opinion category, zero or zero percent responded. Two or 16.6 percent responded agree and ten or 83.3 percent responded strongly agree. This resulted in a mean of 4.83. In the Synergistic Lab situation, zero or zero percent responded

strongly disagree and zero or zero percent responded disagree. In the no opinion category, two or 15.4 percent responded. Six or 46.2 percent responded agree and five or 38.5 percent responded strongly agree. This resulted in a mean of 4.23. The overall mean for this item was 4.53. (See Table 2)

Item number eleven stated that young women and men will be motivated to consider careers in technology. According to the responses in the Lab 2000 situation, zero or zero percent responded strongly disagree and zero or zero percent responded disagree. In the no opinion category, one or 8.3 percent responded. Six or 50 percent responded agree and five or 41.6 percent responded strongly agree. This resulted in a mean of 4.33. In the Synergistic Lab situation, zero or zero percent responded strongly disagree and zero or zero percent responded disagree. In the no opinion category, one or 7.7 percent responded. Nine or 69.2 percent responded agree and three or 23.1 percent responded strongly agree. This resulted in a mean of 4.15. The overall mean for this item was 4.24. (See Table 2)

Item number twelve stated that the students will utilize computers and other educational technology (plotters, video equipment, digitizers) to solve problems and understand technology. According to the responses in the Lab 2000 situation, zero or zero percent responded strongly disagree and zero or zero percent responded disagree. In the no opinion category, zero or zero percent responded. Zero or zero percent responded agree and twelve or 100 percent responded strongly agree. This resulted in a mean of 5. In the Synergistic Lab situation, zero or zero percent responded strongly disagree and zero or zero percent responded disagree. In the

no opinion category, zero or zero percent responded. Four or 30.8 percent responded agree and nine or 69.2 percent responded strongly agree. This resulted in a mean of 4.69. The overall mean for this item was 4.85. (See Table 2)

Inventions and Innovations Goals

Item number thirteen stated that the students will comprehend the contributions of technological inventions in history. According to the responses in the Lab 2000 situation, zero or zero percent responded strongly disagree and zero or zero percent responded disagree. In the no opinion category, one or 9.09 percent responded. Seven or 63.6 percent responded agree and three or 27.3 percent responded strongly agree. This resulted in a mean of 4.18. In the Synergistic Lab situation, zero or zero percent responded strongly disagree and three or 23.1 percent responded disagree. In the no opinion category, one or 7.7 percent responded. Five or 38.5 percent responded agree and four or 30.8 percent responded strongly agree. This resulted in a mean of 3.77. The overall mean for this item was 3.98. (See Table 3)

Item number fourteen stated that the students will enhance creativity and problem-solving abilities. According to the responses in the Lab 2000 situation, zero or zero percent responded strongly disagree and zero or zero percent responded disagree. In the no opinion category, zero or zero percent responded. One or 9.09 percent responded agree and 10 or 90.9 percent responded strongly agree. This

Inventions and Innovations Goals																					
Curriculum Item No.	Lab 2000 Teachers											Synergistic Lab Teachers										
	SD		D		NO		A		SA		$\bar{x}$	SD		D		NO		A		SA		$\bar{x}$	$\bar{x}$
	No.	%	No.	%	No.	%	No.	%	No.	%		No.	%	No.	%	No.	%	No.	%	No.	%		
13. Comprehend the contributions of technological inventions in history.	0	0%	0	0%	1	9.09%	7	63.6%	3	27.3%	4.18	0	0%	3	23.1%	1	7.7%	5	38.5%	4	30.8%	3.77	3.98
14. Enhance creativity and problem-solving abilities.	0	0%	0	0%	0	0%	1	9.09%	10	90.9%	4.91	0	0%	0	0%	1	7.7%	4	30.8%	8	61.5%	4.54	4.73
15. Use the elements of technology, including the tools, materials, processes, energy, information, and people, to create inventions and innovations.	0	0%	0	0%	0	0%	7	6.36%	4	36.4%	4.36	0	0%	2	15.4%	3	23.1%	5	38.5%	3	23.1%	3.69	4.03
16. Apply scientific principles, mathematical concepts, and communications skills to invent new solutions.	0	0%	0	0%	0	0%	3	27.3%	8	72.7%	4.73	0	0%	1	7.7%	1	7.7%	9	69.2%	2	15.4%	3.92	4.33
17. Explore opportunities in technology and develop a positive self image.	0	0%	0	0%	1	9.09%	6	54.5%	4	36.4%	4.27	0	0%	0	0%	1	7.7%	8	61.5%	4	30.8%	4.23	4.25
18. To consider future careers and educational programs.	0	0%	0	0%	1	9.09%	4	36.4%	6	54.5%	4.46	0	0%	0	0%	1	7.7%	9	69.2%	3	23.1%	4.15	4.31
19. Establish small businesses to experience the risks and rewards of entrepreneurship.	2	18.2%	1	9.09%	2	18.2%	1	9.09%	4	36.4%	3.4	2	15.4%	3	23.1%	7	53.8%	0	0%	1	7.7%	2.62	3.07
20. Understand the potential positive and negative effects of technology on the lives and work of humans.	0	0%	0	0%	2	18.2%	5	45.5%	4	36.4%	4.18	0	0%	4	30.8%	1	7.7%	7	53.8%	1	7.7%	3.38	3.78

Table 3

resulted in a mean of 4.91. In the Synergistic Lab situation, zero or zero percent responded strongly disagree and zero or zero percent responded disagree. In the no opinion category, one or 7.7 percent responded. Four or 30.8 percent responded agree and eight or 61.5 percent responded strongly agree. This resulted in a mean of 4.54. The overall mean for this item was 4.73. (See Table 3)

Item number fifteen stated that the students will use the elements of technology, including the tools, materials, processes, energy, information, and people, to create inventions and innovations. According to the responses in the Lab 2000 situation, zero or zero percent responded strongly disagree and zero or zero percent responded disagree. In the no opinion category, zero or zero percent responded. Seven or 63.6 percent responded agree and four or 36.4 percent responded strongly agree. This resulted in a mean of 4.36. In the Synergistic Lab situation, zero or zero percent responded strongly disagree and two or 15.4 percent responded disagree. In the no opinion category, three or 23.1 percent responded. Five or 38.5 percent responded agree and three or 23.1 percent responded strongly agree. This resulted in a mean of 3.69. The overall mean for this item was 4.03. (See Table 3)

Item number sixteen stated that the students will apply scientific principles, mathematical concepts, and communications skills to invent new solutions. According to the responses in the Lab 2000 situation, zero or zero percent responded strongly disagree and zero or zero percent responded disagree. In the no opinion category, zero or zero percent responded. Three or 27.3 percent

responded agree and eight or 72.7 percent responded strongly agree. This resulted in a mean of 4.73. In the Synergistic Lab situation, zero or zero percent responded strongly disagree and one or 7.7 percent responded disagree. In the no opinion category, one or 7.7 percent responded. Nine or 69.2 percent responded agree and two or 15.4 percent responded strongly agree. This resulted in a mean of 3.92. The overall mean for this item was 4.33. (See Table 3)

Item number seventeen stated that the students will explore opportunities in technology and develop a positive self image. According to the responses in the Lab 2000 situation, zero or zero percent responded strongly disagree and zero or zero percent responded disagree. In the no opinion category, one or 9.09 percent responded. Six or 54.5 percent responded agree and four or 36.4 percent responded strongly agree. This resulted in a mean of 4.27. In the Synergistic Lab situation, zero or zero percent responded strongly disagree and zero or zero percent responded disagree. In the no opinion category, one or 7.7 percent responded. Eight or 61.5 percent responded agree and four or 30.8 percent responded strongly agree. This resulted in a mean of 4.23. The overall mean for this item was 4.25. (See Table 3)

Item number eighteen stated that the students will consider future careers and educational programs. According to the responses in the Lab 2000 situation, zero or zero percent responded strongly disagree and zero or zero percent responded disagree. In the no opinion category, one or 9.09 percent responded. Four or 36.4 percent responded agree and six or 54.5 percent responded strongly agree. This

resulted in a mean of 4.46. In the Synergistic Lab situation, zero or zero percent responded strongly disagree and zero or zero percent responded disagree. In the no opinion category, one or 7.7 percent responded. Nine or 69.2 percent responded agree and three or 23.1 percent responded strongly agree. This resulted in a mean of 4.15. The overall mean for this item was 4.31. (See Table 3)

Item number nineteen stated that the students will establish small businesses to experience the risks and rewards of entrepreneurship. According to the responses in the Lab 2000 situation, two or 18.2 percent responded strongly disagree and one or 9.09 percent responded disagree. In the no opinion category, two or 18.2 percent responded. One or 9.09 percent responded agree and four or 36.4 percent responded strongly agree. This resulted in a mean of 3.4. In the Synergistic Lab situation, two or 15.4 percent responded strongly disagree and three or 23.1 percent responded disagree. In the no opinion category, seven or 53.8 percent responded. Zero or zero percent responded agree and one or 7.7 percent responded strongly agree. This resulted in a mean of 2.62. The overall mean for this item was 3.07. (See Table 3)

Item number twenty stated that the students will understand the potential positive and negative effects of technology on the lives and work of humans. According to the responses in the Lab 2000 situation, zero or zero percent responded strongly disagree and zero or zero percent responded disagree. In the no opinion category, two or 18.2 percent responded. Five or 45.5 percent responded agree and four or 36.4 percent responded strongly agree. This resulted

in a mean of 4.18. In the Synergistic Lab situation, zero or zero percent responded strongly disagree and four or 30.8 percent responded disagree. In the no opinion category, one or 7.7 percent responded. Seven or 53.8 percent responded agree and one or 7.7 percent responded strongly agree. This resulted in a mean of 3.38. The overall mean for this item was 3.78. (See Table 3)

Technological Systems Curriculum Goals

Item number twenty-one stated that the students will build upon problem solving and creative thinking experiences of previous classes. According to the responses in the Lab 2000 situation, zero or zero percent responded strongly disagree and zero or zero percent responded disagree. In the no opinion category, one or 9.09 percent responded. One or 9.09 percent responded agree and nine or 81.8 percent responded strongly agree. This resulted in a mean of 4.73. In the Synergistic Lab situation, zero or zero percent responded strongly disagree and two or 15.4 percent responded disagree. In the no opinion category, two or 15.4 percent responded. Five or 38.5 percent responded agree and four or 30.8 percent responded strongly agree. This resulted in a mean of 3.85. The overall mean for this item was 4.29. (See Table 4)

Item number twenty-two stated that the students will utilize interdisciplinary activities and apply basic skills. According to the responses in the Lab 2000 situation, zero or zero percent responded strongly disagree and zero or zero percent

Technological Systems Goals																						
Curriculum Item No.	Lab 2000 Teachers											Synergistic Lab Teachers										
	SD		D		NO		A		SA		$\bar{x}$	SD		D		NO		A		SA		$\bar{x}$	$\bar{x}$
	No.	%	No.	%	No.	%	No.	%	No.	%		No.	%	No.	%	No.	%	No.	%	No.	%		
21. Build upon problem solving and creative thinking experiences of previous classes.	0	0%	0	0%	1	9.09%	1	9.09%	9	81.8%	4.73	0	0%	2	15.4%	2	15.4%	5	38.5%	4	30.8%	3.85	4.29
22. Utilize interdisciplinary activities and apply basic skills.	0	0%	0	0%	0	0%	3	27.3%	8	72.7%	4.73	0	0%	0	0%	2	15.4%	8	61.5%	3	23.1%	4.08	4.41
23. Emphasize student learning and working cooperatively.	0	0%	0	0%	0	0%	1	9.09%	10	90.9%	4.91	0	0%	0	0%	1	7.7%	5	38.5%	7	53.8%	4.46	4.69
24. Provide for concrete learning of abstract concepts about systems and impacts of technology.	0	0%	0	0%	0	0%	6	54.5%	5	45.5%	4.46	0	0%	1	7.7%	1	7.7%	6	46.2%	5	38.5%	4.15	4.31
25. Encourage career assessment through first-hand experiences.	1	9.09%	0	0%	1	9.09%	6	54.5%	3	27.3%	3.91	0	0%	1	7.7%	2	15.4%	9	69.2%	1	7.7%	3.77	3.84
26. Provide recognition for students who succeed, develop leadership, and demonstrate responsibility.	0	0%	1	9.09%	0	0%	3	27.3%	7	63.6%	4.46	0	0%	1	7.7%	3	23.1%	7	53.8%	2	15.4%	3.77	4.11

Table 4

responded disagree. In the no opinion category, zero or zero percent responded. Three or 27.3 percent responded agree and eight or 72.7 percent responded strongly agree. This resulted in a mean of 4.73. In the Synergistic Lab situation, zero or zero percent responded strongly disagree and zero or zero percent responded disagree. In the no opinion category, two or 15.4 percent responded. Eight or 61.5 percent responded agree and three or 23.1 percent responded strongly agree. This resulted in a mean of 4.08. The overall mean for this item was 4.41. (See Table 4)

Item number twenty-three stated that the students will learn and work cooperatively. According to the responses in the Lab 2000 situation, zero or zero percent responded strongly disagree and zero or zero percent responded disagree. In the no opinion category, zero or zero percent responded. One or 9.09 percent responded agree and ten or 90.0 percent responded strongly agree. This resulted in a mean of 4.91. In the Synergistic Lab situation, zero or zero percent responded strongly disagree and zero or zero percent responded disagree. In the no opinion category, one or 7.7 percent responded. Five or 38.5 percent responded agree and seven or 53.8 percent responded strongly agree. This resulted in a mean of 4.46. The overall mean for this item was 4.69. (See Table 4)

Item number twenty-four stated that the students will have an opportunity for concrete learning of abstract concepts about systems and impacts of technology. According to the responses in the Lab 2000 situation, zero or zero percent responded strongly disagree and zero or zero percent responded disagree. In the

no opinion category, zero or zero percent responded. six or 54.5 percent responded agree and five or 45.5 percent responded strongly agree. This resulted in a mean of 4.46. In the Synergistic Lab situation, zero or zero percent responded strongly disagree and one or 7.7 percent responded disagree. In the no opinion category, one or 7.7 percent responded. Six or 46.2 percent responded agree and five or 38.5 percent responded strongly agree. This resulted in a mean of 4.15. The overall mean for this item was 4.31. (See Table 4)

Item number twenty-five stated that the students will be encouraged to assess careers through first-hand experiences. According to the responses in the Lab 2000 situation, one or 9.09 percent responded strongly disagree and zero or zero percent responded disagree. In the no opinion category, one or 9.09 percent responded. Six or 54.5 percent responded agree and three or 27.3 percent responded strongly agree. This resulted in a mean of 3.91. In the Synergistic Lab situation, zero or zero percent responded strongly disagree and one or 7.7 percent responded disagree. In the no opinion category, two or 15.4 percent responded. Nine or 69.2 percent responded agree and one or 7.7 percent responded strongly agree. This resulted in a mean of 3.77. The overall mean for this item was 3.84. (See Table 4)

Item number twenty-six stated that the students will be provided recognition who succeed, develop leadership skills, and demonstrate responsibility. According to the responses in the Lab 2000 situation, zero or zero percent responded strongly disagree and one or 9.09 percent responded disagree. In the no opinion category, zero or zero percent responded. Three or 27.3 percent responded agree and seven

or 63.6 percent responded strongly agree. This resulted in a mean of 4.46. In the Synergistic Lab situation, zero or zero percent responded strongly disagree and one or 7.7 percent responded disagree. In the no opinion category, three or 23.1 percent responded. Seven or 53.8 percent responded agree and two or 15.4 percent responded strongly agree. This resulted in a mean of 3.77. The overall mean for this item was 4.11. (See Table 4)

Lab 2000

In the Lab 2000 situations, only one item had a mean of 5 and only one item or curriculum goal fell below the 3.5 mark on a scale of 1 to 5. With four being agree and five being strongly agree, the results of this survey indicated that the lab was meeting the overall needs to implement the Virginia middle school curriculum goals.

The goal with a mean of five was item no. 12 which was to utilize computers and other educational technology (plotters, video equipment, digitizers) to solve problems and understand technology. One hundred percent of the respondents stated that this goal was being met. The goal that fell below the 3.5 mark is item number 19. It fell in the range of no opinion with a mean of 3.4. Item 19 stated that the students shall establish small businesses to experience the risks and rewards of entrepreneurship.

Synergistics Lab

In the Synergistics Lab situations, there were not any goals that had a mean of five. There were two items or goals that fell below the 3.5 mark on a scale of one through five. With four being agree and five being strongly agree, the results of this survey indicated that the lab was meeting the overall needs to implement the Virginia middle school curriculum goals.

The two items that fell below the 3.5 mark were items 19 and 20. Item 19 had a mean of 2.62 and item 20 had a mean of 3.38. They each fell in the range of 2.5 to 3.5 or no opinion. Item 19 stated that the students shall establish small businesses to experience the risks and rewards of entrepreneurship. Item 20 stated that students will understand the potential positive and negative effects of technology on the lives and work of humans.

Summary

In summary, the results of the survey indicated that all but one goal of the 26 goals for the middle school curriculum were being met by the Lab 2000 and all but two of the 26 goals for the middle school curriculum were being met by the Synergistics Lab. The mean scores for the Lab 2000 were higher than the mean scores for the Synergistics Lab. There were six responses in the disagree or strongly disagree category for the Lab 2000. There were twenty-seven responses in the disagree or strongly disagree category for the Synergistics Lab. Also the

number of instructors responding that they held no opinion was higher in the Synergistics Lab situations. There were only a total of 13 responses in the no opinion category for the Lab 2000 with 35 responses in the no opinion category for the Synergistics Lab.

CHAPTER V

SUMMARY

The problem of this study was to determine if the "High-Tech Laboratories" installed in middle schools in the state of Virginia met the needs of the teachers while implementing the state middle school technology education curriculum goals. To solve this problem, the study was set up to determine the effectiveness of the "high tech" laboratories with regard to implementing the middle school curriculum and make recommendations for facility and curriculum changes based upon the observations of the practicing middle school teachers.

The "High-Tech Laboratories" have only recently been installed in many locations. Of the twelve respondents in the Lab 2000 category, two had been teaching in the lab for three years, three for two years, and seven for one year. Out of the thirteen respondents in the Synergistics Lab category only one had been teaching in the lab for two years. The rest had been teaching in the lab for one year.

One of the "high tech" labs, the Lab 2000, consisted of technology islands, a fabrication center, a hydroponic greenhouse area and an experimental structures zone. Each technology island contained three work/learn stations that could be altered by the instructor. The laboratory came equipped with learning modules (packets) that contained base information, instruction and activities to be performed.

The other "high tech" lab, the Synergistics Lab for Exploration in Technology, was configured for 36 students per hour to explore 18 different technology modules.

Twenty-four module workstations were designed for this program with three instructors team-teaching. The original modules included Electricity/Electronics; Drawing, Drafting and Design; Applied Physics; Automobile Engine Systems; Small Gas Engines; Performance Vehicles; Research and Design; Computer Applications; Think Tank; Rocketry and Spaceflight; Production Technology; Computer Numerical Control; Transportation; Robotics; Flight Technology; Future Technology; Desktop Publications; and Radio/Communications. Because of the many different activities that needed to be covered at the same time, a self-paced teaching system was developed that placed the responsibility for learning directly on the students. They were responsible for vocabulary words, study questions, and pre- and post-test scores for each module. Of the teachers responding in Virginia, three of the teachers were teaching alone in the Synergistics lab. The other respondents were either team teaching or sharing the responsibilities of the sixth, seventh and eighth grade students.

Conclusions

According to the data gathered in this survey and presented in Tables 1 through 4, the teachers felt that the "high tech" labs were meeting the needs of the Virginia Middle School Curriculum goals. Only one item out of 26 had a mean below the 3.5 mark for the Lab 2000 and two items out of 26 had a mean below the 3.5 mark for the Synergistics Lab.

Of the two "high tech" labs, the Virginia Department of Education was of the opinion that the Lab 2000 more closely met the needs of the middle school technology education curriculum. This was proven to be true according to the data collected in the Virginia Middle School Curriculum Goals Survey which showed 25 out of 26 items with a higher mean for the Lab 2000. Only item 6 had a higher mean for the Synergistic Lab (Tables 1 through 4). Therefore, the Virginia Department of Education was correct in their belief that the Lab 2000 is more closely meeting the needs of the middle school program.

The Lab 2000 had only one item with a mean of five and the Synergistics Lab had no items with a mean of five which indicates that there is room for improvement in the design of the "high tech" labs. The mean of most of the items was closer to the range of "agree" as compared to "strongly agree."

The curriculum goals for the three middle school areas and the design of the two "high tech" labs need to be revised in order to totally meet the needs of the middle school program. Further detail as to how is provided in the recommendations section of this chapter.

Recommendations

There are several alternatives available to meet the goals of the Virginia Middle School Curriculum. One would be to combine components of the two different labs. Another would be to combine the labs with existing equipment from the previously

used technology labs. A third would be to write design briefs and problem-solving lessons tailored to the goals that are inadequately met. A combination of ideas could be used. The ultimate responsibility is with the individual teacher to make alterations in their lab and lessons plans to ensure the goals are being met through their activities. Another possibility is to consider rewriting the curriculum goals.

As an example of how the teacher is ultimately liable for the goals being met, consider item 20. Item 20 states the students need to understand the potential positive and negative effects of technology on the lives and work of humans. This is not a hands-on activity. Instead it is something the teachers and students should discuss. An appropriate method of teaching this lesson would be to have a brainstorming session or question and answer session (i.e., how technology effects our environment) to draw out their understanding of how technology effects our lives. This should be accomplished with questions on different levels of Bloom's Taxonomy compared to short answer questions.

The results of this research could be used to help school systems determine whether or not to purchase "high tech" labs as one component or pieces, whether or not to purchase the labs at all, and which lab to choose. According to the results, the mean for each item was higher for the Lab 2000. Therefore, if an entire lab were purchased, the best investment would be the Lab 2000. The results could also be used by the companies selling the labs in order for them to make improvements. A good way for them to better meet the needs of their customers would be to gain access to curriculum goals and work closely with teachers using the facilities.

Item 19 is the item that was not being met by either the Lab 2000 or Synergistics Lab. It states that the students shall establish small businesses to experience the risks and rewards of entrepreneurship. First the Virginia Technology Education Department would need to determine if this goal is reasonable and feasible. If they believe it is still an essential element of technology education in the middle school program, a solution is needed for both labs. The problem could be solved by adding another island to both labs. Since the concept is what is being stressed, not the size of the item, the items being manufactured by the business could be built with small hand tools or exacto knives and balsa wood, straws, paper, cardboard and other such materials. For the Synergistics Lab, a complete island with essential equipment could be added. The Lab 2000 provides computers and Lego/Logo kits for the mechanization of inventions. This could provide the assembly line needed to operate a business. The items being manufactured by the business could be built on a new island incorporating existing equipment. Another option would be to list item 19 as an optional curriculum goal for those with existing equipment to make it feasible.

Further research could be done in this area to improve the Lab 2000 and Synergistics Lab. A recommendation would be to use the subjects presently using the "high tech" labs. The individuals will more than likely change somewhat from the list used for this research as teachers move around and more labs are added. It is suggested to interview the individuals (compared to a survey) in order to allow them to express their opinions. They could provide specific input as to the problems they

have encountered using the "high tech" labs. This could lead to ways to improve the labs to meet the goals of the curriculum and to make the labs more efficient and effective.

BIBLIOGRAPHY

Barrowman, Thomas, Max Lundquest, and Kim Durfee. "Facility Design in Action," TIES, (March/April 1991), 35 - 40.

Durfee, Kim. "Salt Lake City, Utah," The Technology Teacher, (March 1988), 39 - 43.

Hughes, Thomas. Principal Specialist, Virginia Department of Education.

Neden, Mike, John Iley, and Patrick Winchester. "Pittsburg, Kansas--Revisited," The Technology Teacher, (April 1988), 23 - 26.

Neden, Michael. "Delta County Technology Project," The Technology Teacher, (December 1990), 25 - 29.

Technology Education Service, Commonwealth of Virginia. "Technology Education Instructional Tasks/Competencies for Introduction to Technology," 1988.

APPENDICES

APPENDIX A -Virginia Middle School Curriculum Goals Survey

APPENDIX B - Virginia Middle School Curriculum Goals Cover Letter

APPENDIX A

Virginia Middle School Curriculum Goals Survey

THE IMPLEMENTATION OF "LAB 2000" AND "SYNERGISTIC SYSTEMS" IN MIDDLE SCHOOL LABORATORIES IN VIRGINIA

SURVEY

The purpose of this research is to determine if the "high tech" labs set up in middle schools in Virginia enable the teachers to meet the goals and objectives of the Virginia Department of Education Curriculum Guides.

Please answer the following questions related to your facility.

1. Which type of "high tech" lab are you using? Lab 2000 Synergistics Lab

2. How many years have you been using the "high tech" lab? 1 2 3 4 5 6

DIRECTIONS: The following criteria are the goals for the overall Technology Education curriculum, the Introduction to Technology curriculum, the Inventions and Innovations curriculum and the Technological Systems curriculum respectively. Please answer the following questions by circling the appropriate response to each statement and return it by June 7, 1991. They should be answered using the following criteria:

1. Strongly disagree
2. Disagree
3. No opinion
4. Agree
5. Strongly agree

The "high tech" lab I am using enables my students to:

Technology Education

1. Comprehend the dynamics of technology, including its development, impact and potential.	1	2	3	4	5
2. Employ the technological processes of problem-solving, creating, and designing.	1	2	3	4	5
3. Analyze the behavior of technological systems and subsystems, including the tools, materials, processes, energy, information, and people involved in systems.	1	2	3	4	5
4. Apply scientific principles, engineering concepts, and technological systems in the processes of technology.	1	2	3	4	5
5. Discover and develop personal interests and abilities related to a wide variety of technology-oriented careers.	1	2	3	4	5

APPENDIX B

Virginia Middle School Curriculum Goals Cover Letter

24 May 1991

Dear :

Virginia technology teachers are very excited by the implementation of "high-tech" laboratories in the middle school program and anxiously await the same in the high school situation. As a research project I have developed a study to determine how effective our new labs are in helping you to implement the middle school curriculum. Your input could assist school divisions in their choice of which lab to invest.

As the end of the school year is rapidly approaching, the best way for me to gather this information is through a survey. I have included a survey and self addressed envelope for your response. Please complete the survey and return it to me by June 7, 1991.

Please accept my thanks in advance for your cooperation.

Professionally,

Patricia Ways
Teacher
Technology Education