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### A Study to Determine if the Major Virginia School Systems are Teaching Middle School Technology Using Modular or Traditional Laboratory Arrangements

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A STUDY TO DETERMINE IF THE MAJOR VIRGINIA  
SCHOOL SYSTEMS ARE TEACHING MIDDLE SCHOOL TECHNOLOGY  
USING MODULAR OR TRADITIONAL LABORATORY ARRANGEMENTS

A Research Paper

Presented to the Graduate Faculty  
of the Department of Occupational and Technical Studies  
at Old Dominion University

In Partial Fulfillment  
of the Requirements for  
the Master of Science in Education Degree

By  
John R. Begley  
August 1997

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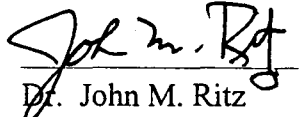
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APPROVAL PAGE

This research paper was prepared by John R. Begley under the direction of Dr. John M. Ritz in OTED 636, Problems in Education. It was submitted to the Graduate Program Director as partial fulfillment of the requirements for the Degree of Master of Science of Education.

APPROVAL BY:

  
Dr. John M. Ritz  
Advisor and Graduate  
Program Director

8-15-97  
Date

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## CHAPTER I

### INTRODUCTION

Technology touches our lives every day in some way or form. Most people cannot make it through the day without the use of or benefit from technology. Recent technological developments have presented people with such marvels as the exploration of the farthest reaches of the solar system, personal computers capable of storing an encyclopedia on a small optical disc, and the transplantation of human organs. (Volti, 1995, p. 3)

According to the Competitiveness Policy Council, the development and application of technology is a key driver of American economic growth, competitiveness, and increases in the US standard of living. In addition, competition in many of the fastest growing manufacturing industries, including electronics, biotechnology, aerospace, and communications, is primarily based on skill in developing and applying technology. (Competitiveness Policy Council, 1993, p. 1)

As society becomes more dependent on technological advances, today's schools must be able to prepare students for their future in a technology-based society. In order to help students be competitive, use, and understand technology, some of our public school systems are now using innovative ways to accomplish this task. The traditional Industrial Arts or Shop classes are now being converted to modular technology education



labs. These modular labs can help students develop processes of problem solving, creating, and designing. In addition, the modular lab facilitates the understanding and impact of technology on society.

A major advantage of the modular lab is the flexibility it offers teachers. Teachers can change and adapt their modules to what is best for their students and for the individual classroom dynamics. If the teachers have time and ability, a module developed especially for their students is most effective. (Gloeckner, 1996, p. 16) Furthermore, a modular lab offers flexibility needed to be able to upgrade and change as technology changes.

There are early indications that modular education helps students. Dobrauc, Harnish, and Jerich (1995) studied seventh and eighth grade students' in eight school districts through two different studies using Synergistic modular laboratories. They found that modular education has a positive effect on: (a) desire to learn, (b) interest in doing research, (c) self-esteem, and (d) ability to work with classmates. (Gloeckner, 1996, p. 18)

This researcher believes these state-of-the art modular labs are expanding to different school systems throughout Virginia. The purpose of this study seeks to determine if the major Virginia School Systems are using modular technology labs to teach Technology Education.

## STATEMENT OF THE PROBLEM

The problem of this study was to determine if the major Virginia School Systems are teaching Middle School Technology using modular or traditional laboratory arrangements.

## RESEARCH GOALS

The goals of this research project were to:

1. Determine if the major Virginia School Systems are teaching Middle School Technology Education using modular or traditional laboratory arrangements.
2. Determine which major Virginia Middle Schools are teaching Technology Education using modular or traditional laboratory arrangements.

## BACKGROUND AND SIGNIFICANCE

In June 1988, two technology teachers from Blue Ridge Middle School in Loudoun County, Virginia, went to Pittsburg, Kansas, to attend a workshop. This workshop was called "The Modular Method of Delivering Technology Education in the Middle School." (Fulcer, 1996, p. 16) The purpose of the visit was to collect information on Technology Labs that could be modified to meet the needs of Loudoun County and the State of Virginia. A year later Blue Ridge Middle School became the

first in Virginia and the Mid-Atlantic area to have a modular technology lab. In mid November of that same year, an open house/demonstration was held with approximately eighty-five educators from Virginia, Maryland and Delaware attending. (Fulcer, 1996, p. 17) During this open house/demonstration the educators were introduced to the concept of using modular labs to teach technology education. Since that time modular labs have gained in popularity as a means to teach technology education.

These modular labs are usually carpeted and equipped with modern furniture and equipment. Furthermore, the lab consists of stations that provide students with active learning situations and higher-order thinking skill development through practical problem solving experiences. The modular labs also have proven to be great platforms for schools to meet and exceed the competencies established by the Technology Education Department of the Virginia Department of Education. While it is known that different major school systems in Virginia are using modular technology labs in the Middle School, it is not known how many and which school systems are using them.

### **LIMITATIONS**

The limitations of this study were as follows:

1. This study was limited to surveying Middle Schools in city or county school systems in Virginia who have full time supervisory personnel assigned to technology education.
2. This study was limited by the number of responses to the survey which was conducted.

## ASSUMPTIONS

In this study there were factors which were assumed to be true and correct. The assumptions were as follows:

1. The supervisors answered the survey correctly.
2. All major Virginia school systems teach some form of Technology using either modular labs or the traditional laboratories.

## PROCEDURES

This study will be conducted by mailing a survey to all major Virginia Middle School system technology supervisors. This form will ask the supervisors to complete the questions and return the form in a self-addressed envelope. After the results are returned and tabulated, a comparison will be made to determine which Middle Schools use modular technology labs or traditional laboratory arrangements.

## DEFINITION OF TERMS

For clarification, the following terms should be understood:

*Major Virginia School Systems* - For the purpose of this research, the major Virginia School Systems are those with populations consisting of 10,000 or more residents.

*Traditional laboratory arrangements* - A general technology laboratory with various machines and supplies that can be used to teach the technological systems of manufacturing, construction, communication, and transportation. It is set up as a technological / industrial environment.

*Modular laboratory arrangements* - Are those laboratory arrangements which consist of different technology modular work stations which help teach manufacturing, communication, construction or transportation.

## OVERVIEW OF CHAPTERS

This study seeks to determine if the major Virginia Middle Schools systems are teaching Middle School Technology Education using modular or traditional laboratory arrangements. A through review of the available literature on this subject will be presented, and a complete methodology of how the research was conducted will be provided. The results of the study will be described and analyzed for significance. Recommendations for further studies will be provided.

## CHAPTER II

### REVIEW OF LITERATURE

In the second chapter of this study, a review of the current literature dealing with Middle School Technology using modular or traditional laboratory arrangements was conducted. In an effort to determine what major Virginia school systems use modular arrangements, it was first appropriate to examine and explain the modular arrangements as compared to traditional laboratory arrangements. In addition, current trends in Middle School technology education were examined. Lastly, literature was reviewed to determine the benefits of modular laboratory arrangements.

### MODULAR LABORATORY ARRANGEMENTS

A module is a defined lab space where students spend a majority of their classroom time completing the instructional activities. This space is equipped with all the materials, tools and equipment that students may require to complete the learning activities. The students follow a set of self-directed instructions that introduce concepts, reinforces the concept, provides hands-on activity demonstrating the concept and allows for validation and evaluation by the instructor. (Petrina, 1993, p. 1)

These modular laboratory arrangements are also referred to as Modular Technology Education systems (MTE). The MTE teaching system divides the classroom into multiple learning stations, each manned by a team of two students. The student teams rotate through a series of programs, moving from one program to another throughout the grading period. Rather than lecturing to the entire class, the teacher is a facilitator, coaching student teams individually as needed. (Hearlihy, 1997, p. 1)

In addition, another term for modular laboratory arrangements is the “modular approach to technology education” (MATE). The MATE and MAT are two different terms basically describing modular labs. They are both designed around self-contained, two student-workstations that support self-directed, individualized instructional methodologies. (Petrina, 1993, p. 1)

The modular laboratory arrangements are a departure from traditional “shop” arrangements. For example, the modular arrangements address technologies such as robotic automation, biotechnology, solar energy, manufacturing, construction and transportation. The teachers’ role is more of a facilitator than lecturer. One way they accomplish this is through desk-top equipment and related computer software.

## TRADITIONAL LABORATORY ARRANGEMENTS

The traditional laboratory arrangements are mainly teacher-directed instruction. They can focus on the manufacture of projects which teach primarily basic manual skills or be designed to teach the technological systems of manufacturing, construction, communications, and or transportation. Students often work independently and receive instructions through discussion and demonstration methods. This is the way that technology education traditionally has been defined.

## TRENDS

In the period 1860 through 1960 the United States labor force was comprised of about 20% service workers. However, since 1960, the portion of service workers has risen dramatically. As of 1987, information workers held more than 50% of all jobs. (Baker, 1992, p. 6) This recently recognized shift in employment patterns from manufacturing-based employment to information-based employment has influenced the shift from an industrial materials content base to a technology systems base in contemporary technology education programs. (Baker, 1992, p. 8) With this in mind, the skills required of workers have consistently become more complex. Literacy is no longer an option. Increasing job complexity requires high-order thinking skills and problem solving capabilities in a world of local area networks (LANs), fax, and e-mail. (Baker, 1992, p. 8)



Toffler (1990) observed that the information age does not need workers who are essentially interchangeable workers as in the industrial era, but rather individuals with diverse and continually evolving skills. (Baker, 1992, p. 8) Furthermore, Wright (1990) pointed out more specifically the need for developing students who are flexible, adaptive, life-long learners who can effectively work in groups. These students should also have good problem solving skills and a broad understanding about technology. (Baker, 1992, p. 8)

While carpenters, plumbers and electricians are still needed, many of the jobs being created in this country demand that students use a variety of skills including those in communication, math and science. (McCade, 1995, p. 37) Today, many school systems are changing their traditional laboratory arrangements to modular technology labs. The shop classes that served the industrial society of the early 20<sup>th</sup> century no longer adequately prepare the students for the world of work today. The concept of modular technology education labs is catching on rapidly after a slow take-off in middle schools according to the suppliers. High schools, too, are boasting more modular technology labs. (Mulford, 1995, p. 34)

### **BENEFITS OF MODULAR TECHNOLOGY**

Research conducted by Kenneth Welty, University of Wisconsin, stated the following impacts on teaching styles using a modular approach:

1. Teacher-directed teaching methods (e.g., lecture method, discussion method, and demonstration method) decreased in frequency of use.
2. The use of student-oriented instructional material (e.g., computer aided instructional software) increased dramatically, whereas the use of teacher-oriented instructional material (e.g., transparencies) decreased significantly.
3. The frequency of students working in pairs increased dramatically, whereas the traditional practice of having students working alone on learning tasks went down significantly.

In addition, research showed a dramatic increase in engaging students in inquiry, problem solving, and simulation. However, the use of projects decreased significantly.

(Baker, 1992, p. 6) Other advantages of modular technology included:

1. Flexibility, modular laboratories offer great flexibility which enables the teacher to change lessons to fit student needs without changing the entire curriculum.
2. Minimal equipment cost for many activities.
3. Ability to update as technology changes.
4. Clear and concise testing. (Gloeckner, 1996, p. 19)

## SUMMARY

This chapter has examined modular laboratory arrangements as compared to traditional laboratory arrangements. In addition, it has examined current trends and benefits of modular laboratory arrangements.

Technology is changing our society to a information based society. As of 1997, information workers held more than 50 % of all jobs. In order to prepare our children for the 21st century, we must teach technology education in our schools. One of the ways to teach technology education is through modular technology laboratory arrangements.

## **CHAPTER III**

### **METHODS AND PROCEDURES**

This research is a descriptive study seeking to determine if the major Virginia School Systems are teaching Middle School Technology using modular or traditional laboratory arrangements. A description of the population studied, research procedures used, type of statistical analysis performed, and summary of the methodology follow.

#### **POPULATION**

The population of this study consisted of Middle Schools in city or county school systems in Virginia who have full-time supervising personnel assigned to technology education. There were nineteen school systems in the state of Virginia which fit this description.

#### **RESEARCH PROCEDURES**

A survey was designed to gather data that would help answer the research goals. This survey was developed and mailed to nineteen Middle school systems in the state of Virginia who have full-time supervising personnel. This survey consisted of questions asking the respondent if they used modular technology laboratories or traditional

laboratory arrangements to teach technology education in their school system. A copy of the survey is found in Appendix A with its accompanying cover letter in Appendix B.

### **STATISTICAL PROCEDURES**

Statistical data was determined through the use of percentages and a table. The total number of modular laboratories were divided by the total number of laboratories to determine the percentages.

### **SUMMARY**

The methods and procedures for the research study were discussed in this chapter. The survey was mailed to middle school systems in the state of Virginia who have full-time technology supervisors. The survey data will be analyzed in the next chapter through the use of percentages and a table.

## CHAPTER IV

### FINDINGS

Chapter IV of the study contains the results of a survey mailed to nineteen school systems in Virginia who have full time supervising personnel assigned to technology education. The survey was designed to determine if the major Virginia School Systems are teaching Middle School Technology using modular or traditional laboratory arrangements. In addition, the data was used to determine which major Virginia Middle Schools are teaching Technology Education using modular or traditional laboratory arrangements.

### SURVEY RESULTS

As indicated in Table 1, responses were received from 19 personnel or 100 percent of the population surveyed. The survey results in Table 1, reveal that there were 136 Middle Schools, with a total of 232 laboratory arrangements. Out of these 232 labs, 118 labs (51 percent) were modular in nature. In addition, eight of the nineteen school systems teach technology education solely by modular laboratory arrangements. The other school systems use both modular laboratory arrangements and traditional laboratory arrangements. The survey also revealed that 68 percent of the school districts have 50 percent or more of their technology facilities comprised of modular labs.

The Hampton School system was found to have the least number of modular labs in relation to the total number of technology labs. Only twenty percent of their technology labs were modular.

**POPULATION  
TABLE 1**

**MODULAR LABORATORY ARRANGEMENTS**

<b>SCHOOL DISTRICT</b>	<b>NUMBER OF MIDDLE SCHOOLS</b>	<b>NUMBER OF MODULAR LABS</b>	<b>NUMBER OF LABS</b>	<b>% WITH MODULAR LABS</b>
Arlington	5	3	5	60%
Chesapeake	7	14	14	100%
Chesterfield	11	5	15	33%
Danville	3	3	3	100%
Fairfax County	23	16	46	34%
Frederick	3	3	6	50%
Hampton	6	1	10	10%
Henrico	8	8	14	57%
Loudoun	5	5	5	100%
Louisa	1	1	1	100%
Lynchburg	3	6	9	66%
Newport News	7	3	4	75%
Norfolk	8	9	9	100%
Petersburg	1	1	1	100%
Prince William Co.	13	15	36	41%
Richmond	9	2	10	20%
Roanoke County	5	5	5	100%
Stafford County	5	5	10	50%
Virginia Beach City	13	13	29	44%
<b>Total</b>	<b>136</b>	<b>118</b>	<b>232</b>	<b>51%</b>

## SUMMARY

This chapter has revealed the findings of the survey conducted to determine if the major Virginia School Systems are teaching Middle School Technology using modular or traditional laboratory arrangements. In addition, the data was used to determine which Virginia Middle Schools are teaching Technology Education using modular or traditional laboratory arrangements.

Responses were received from 19 personnel or 100 percent of the population surveyed. The survey results were compiled in Table 1, which revealed that there were 136 Middle Schools, with a total of 232 laboratory arrangements. Out of these 232 labs, 118 labs, 51 percent, are modular. Chapter V will provide the Summary, Conclusions and Recommendations of the study.



## CHAPTER V

### SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

#### SUMMARY

The problem of this study was to determine if the major Virginia school systems are teaching Middle School technology using modular or traditional laboratory arrangements. The goals of the research project were to determine if the Virginia school systems are teaching middle school technology education using modular or traditional laboratory arrangements. In addition, it will determine which schools are teaching technology education using modular or traditional laboratory arrangements.

During the review of literature, it was discovered in the period from 1860 through 1960 that the United States labor force was comprised of about 20 percent service workers. However, since 1960, the portion of service workers has risen dramatically. As of 1987, information workers held more than 50% of all jobs. (Baker, 1992, p. 6) This recently recognized shift in employment patterns from manufacturing-based employment to information-based employment has influenced the shift from a industrial materials content base to a technology systems base in contemporary technology education programs. (Baker, 1992, p. 8) In order to prepare our children for the 21<sup>st</sup> century, we must teach technology education in our schools. One method to do this is by using modular technology laboratories.

The review of literature also examined some of the advantages of modular technology which included:

1. Flexibility, modular laboratories offer great flexibility which enables the teacher to change lessons to fit student needs without changing the entire curriculum.
2. Minimal equipment cost for many activities.
3. Ability to update as technology changes.
4. Clear and concise testing. (Gloeckner, 1996. P. 19)

The method and procedures used during this study was conducted by mailing a survey to all major Virginia Middle School system technology supervisors. This form asked the supervisors to complete the questions and return the form in a self-addressed envelope. After the results were returned, they were tabulated and compared to determine which Middle Schools use modular technology labs or traditional laboratory arrangements. A 100 percent response was gained.

### CONCLUSIONS

Based upon the research goals of this study, the following conclusions were provided:

1. Determine if the major Virginia School Systems are teaching Middle School Technology Education using modular or traditional laboratory arrangements. The research shows that 100 percent of the school systems surveyed use modular laboratory arrangements to teach technology education. However, some school districts do not use

modular laboratory arrangements in all of their schools. The survey results revealed that there were 136 Middle Schools, with a total of 232 laboratory arrangements. Out of these 232 labs, 118 (51 percent) are modular.

2. Determine which major Virginia Middle Schools are teaching Technology Education using modular or traditional laboratory arrangements. Research showed 51 percent of the schools surveyed use modular arrangements. These school districts include:

Arlington	Lynchburg
Chesapeake	Newport News
Chesterfield	Norfolk
Danville	Petersburg
Fairfax County	Prince William Co.
Frederick	Richmond
Hampton	Roanoke County
Henrico	Stafford County
Loudoun	Virginia Beach City
Louisa	

From these findings, the researcher concludes that modular technology laboratory arrangements play a significant role in teaching middle school technology in the state of Virginia. Therefore, it would be beneficial for institutions who prepare students to become technology teachers to include modular type technologies in their curriculum.

## RECOMMENDATIONS

Based upon the research findings and conclusions of this study, the researcher includes the following recommendations:

1. Similar research should be repeated, in the same format, with a larger sample.
2. Include High Schools in the survey.
3. Insure that University programs have instruction in teaching modular technology.
4. Determine which modular systems are used in Virginia technology education.

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**APPENDICES**

APPENDIX A - Sample of Research Survey

APPENDIX B - Sample of Cover Letter

## APPENDIX A

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**Modular Method of Teaching Technology Education Survey**

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Purpose: To determine if the major Virginia School Systems are teaching Middle School Technology using modular or traditional laboratory arrangements.

Directions: Please answer the questions below and return this form in the enclosed envelope.

Name \_\_\_\_\_

School Division \_\_\_\_\_

Telephone number \_\_\_\_\_

---

1. Please circle the type of facilities used to instruct Middle School technology in your district.

- a. Modular laboratory arrangements
- b. Traditional laboratory arrangements
- c. Both

2. How many Middle Schools do you have in your school district? \_\_\_\_\_

3. How many Middle School laboratories do you have in your total number of Middle Schools? \_\_\_\_\_

4. How many of these laboratories are modular in nature? \_\_\_\_\_

---

**Thank you for your valuable assistance!**

**Please return this form in the enclosed envelope**

**APPENDIX B**

8 May 1997

Dear :

As a Technology Education Specialist, you possess unique knowledge regarding the instructional delivery of this program area. As an expert, your information is extremely important to me in conducting a current research project. This project is to determine if the Virginia school systems are teaching Middle School Technology using either modular or traditional laboratory arrangements. In addition, I would like to determine which and how many Middle Schools are using modular or traditional laboratory arrangements.

I am a graduate student currently enrolled at Old Dominion University in Norfolk, Virginia, and working on this project with Dr. John R. Ritz. My specialization is in Technology Education at the middle school level. To solve my research problem, I am distributing surveys to all full-time supervisory personnel assigned to technology education in Virginia. Your participation in this study is vital to solving my research problem.

I thank you in advance for your assistance in helping me achieve my goal. Please complete and return the enclosed survey by June 6, 1997, so that we can compile the data and use it to better prepare teacher education graduates.

Sincerely,

John R. Begley  
5068 Andover Rd.  
Virginia Beach, Virginia 23464

Enclosure