2002

Project UPDATE-Technology Education-and the Impacts on Virginia Standards of Learning Achievement

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Project UPDATE-Technology Education-and the Impacts on Virginia Standards of Learning Achievement

In Partial Fulfillment Of The Requirements For The Degree Master of Science In Occupational And Technical Studies

Old Dominion University

By

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December 2002

SIGNATURE PAGE

Doyle L. James prepared this research paper under the direction of Dr. John M. Ritz in OTED 636, Problems in Occupational and Technical Studies. The report was submitted to the Graduate Program Director as partial fulfillment of the requirements for the degree of Master of Science in Occupational and Technical Studies.

Approved By

John M. Ritz — 12-15-02

Dr. John M. Ritz, Advisor and Graduate Program Director — Date

ACKNOWLEDGEMENTS

A sincere thank you to the administration and guidance department of Cooper Elementary School in Hampton, Virginia. Their support made this study possible. Addition thanks are extended to my wife Jacqueline, and my three children for the encouragement and understanding that allowed this author to complete this research. A special thank you is extended to Dr. John Ritz for without his guidance, this research project would not be complete.

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CHAPTER I

INTRODUCTION

Technology is a part of everyday life, which means that learning about technology needs to start at a much younger age than it did twenty years ago. Industrial Arts curriculum of the 1980's and before will not adequately prepare our children for their future, which will be inextricably linked with technology. Integrating technology into the school curriculum starting at the pre-school level will help to prepare students for the future that they face, which will be more technologically amazing than it is now. Research has been done to determine if bringing technology education into the lower grades would be an effective way to begin preparing students for life. One of the current efforts toward that goal is Project UPDATE (Upgrading Practice through Design and Technology "Engineering" Education).

The original Project UPDATE (Upgrading Practice through Design and Technology "Engineering" Education) was aimed at teaching technology at the K-8 grade levels. The original intent was to build upon the leadership in primary Design & Technology (D&T) provided by the United Kingdom education system (Benson, 1998). A continuation, and expansion of Project UPDATE, is project UPDATE/TEI (Teacher Enhancement Initiative). TEI extends the project by providing the teachers the tools necessary to implement the project UPDATE concept in their schools, instead of relying on outside help to teach the design and technology concepts.

Statement of the Problem

The problem of this study was to compare the Virginia SOL scores of a Group of fourth grade students at Cooper Elementary School who had project UPDATE education in design and technology compared to fourth grade students at Cooper Elementary School who did not receive the education.

Research Goals

To solve this problem, the following hypothesis was tested:

H_1: Teaching students design and technology using the project UPDATE methods and materials will improve students fifth grade Virginia SOL scores.

Background and Significance

Project UPDATE focused on the development of materials that would support elementary teachers in the efforts to implement a design and problem solving approach to teaching and learning in their classroom. Project UPDATE materials provide teachers with design and technology (D&T) activities that engage students in grades K-8 in active and reflective learning experiences.

The materials for project UPDATE are organized into Conceptual Learning Units (CLU). The goal for a CLU is to maintain a theme throughout the unit, and include many subjects, i.e., Mathematics, Geography, History, and Design and Make (Technology). Each CLU is different and includes a variety of subjects, however they all have common characteristics. They focus on four general themes: travel, the built environment, special events, and devices and inventions. They are different from the

themes currently in use in public schools today because they incorporate an opportunity for students to design and make solutions to real, tangible problems. The problems are chosen in order to stimulate deeper investigation into mathematics and science. The concepts discovered by project UPDATE cover a wide range of Virginia SOL's, not merely by memorizing the information, but by learning through problem solving activities.

It is important for parents, teachers, administrator, and students to realize the impact that problem solving has on life today. The ability to not only understand a problem exists, but to design, and then create a solution is the cornerstone of learning in today's society. The earlier we can introduce these concepts, the better students can design and make, and prepare for their future.

Technology is infused into our everyday lives. The focus of this study is to determine if introducing design and technology concepts at the fourth grade level using project UPDATE methodology will improve not just the technology SOL scores, but all of their SOL scores. Answering the questions posed in this paper will hopefully help to bring notice to the need to push technology education down to the elementary school level permanently and eventually make it a core subject instead of an elective.

Limitations

This study was conducted in good faith, however, the limitations of this study must be considered, and were as follows:

1. The results of this study were confined to fourth grade classes at Cooper Elementary school in Hampton, Virginia.
2. This research did not include observations of the training, but instead it relied on evaluating student performance via post training data.
3. This researcher was not able to supervise students, and document any outside assistance students received in preparing for the Virginia SOL tests outside of the classroom.
4. Students volunteered for the training.

Assumptions

In this study factors believed to be true for all students and teachers involved were as follows:

1. All students in the control group received the same training.
2. The teachers were trained in project UPDATE methodology.
3. The students did not receive specialized training in Virginia SOL preparation as part of the project UPDATE education.

Procedures

Virginia SOL scores of fourth grade students who participated in project UPDATE education were collected and compared to the SOL scores of their classmates not enrolled in project UPDATE. The scores were compared to determine if there was a significant difference from those who received project UPDATE education as compared to those who did not receive project UPDATE education.

Definition of Terms

For the purposes of this research, key terms are defined to assist in the understanding and use of this study.

1. UPDATE - Upgrading Practice through Design and Technology "Engineering" Education. A concerted effort to prepare teachers to use design and technology (D&T) and integrated science, mathematics and technology (S/M/T) approaches.
2. TEI - Teacher Enhancement Initiative. Enriches the original project by providing participating teachers with knowledge, skills and experiences for implementing the UPDATE materials and approach.
3. SOL – Standards of Learning. A performance based test used in Virginia to evaluate students learning.
4. D&T - Design and Technology. The acquisition and application of knowledge through context-based problems.
5. S/M&T - Science, Mathematics, and Technology. The three core subjects used in project UPDATE.
6. Teacher/Leader – A teacher trained to teach other teachers in the D&T and S/M&T approaches using UPDATE methods and materials.

Overview of Chapters

Chapter I addresses the importance of starting education in technology at the elementary school level. Project UPDATE is based on that philosophy, and the

background information as well as the initial goals for this project are discussed. The goal is to compare the Virginia SOL scores of fifth grade students at Cooper Elementary School who had project UPDATE education in D&T in fourth grade, compared to fifth grade students at Cooper Elementary School who did not receive the education in fourth grade.

Chapter II will review other research that has been completed on the subject of early introduction to D&T and its effect on standardized test scores. Chapter III will address the methodology used in completing the study. Chapter IV explains the results of the study. Chapter V concludes the study, and it offers recommendations for future research.

CHAPTER II

REVIEW OF LITERATURE

The amount of literature available on the subject of integrating Design and Technology into the curriculum is staggering. Most of that information is at the undergraduate and graduate level, with some research done at the lower levels. Narrowing that to the elementary school level brings the amount of literature available down to just a few articles, unless you consider other countries besides the United States. This review will cover the Design and Technology curriculum in the United Kingdom, project UPDATE, Peakview Elementary School, a new paradigm for schooling, and implementing a national program.

Design and Technology, or technology education, is taught extensively throughout the U.S. at the ninth grade level and above. Most schools have some type of technology education at the six through eighth grade levels. The United States has been studying integrating technology of some type into the elementary school curriculum for decades. The problem is that besides Project UPDATE, there are few schools actually accomplishing technology integration at the elementary school level. One of the success stories is Peakview Elementary School, Aurora, Colorado. As you read the reviews you will understand the need for this study, and further implementation of technology and problem solving into the elementary school curriculum.

Design and Technology in the United Kingdom

The United Kingdom has a national curriculum established in 1990, of which Design and Technology (D&T) is a vital part. Starting September 1990 technology became a compulsory subject for all pupils age 5 to 16. Not only is it a mandatory subject, it is cross curricula. Teachers of all subjects are required to include D&T concepts in their lessons. D&T is paired with Information Technology (IT) to create the foundation subject area Technology.

The D&T of the past prepared a student for a trade like weaving or metalworking. The D&T of the present must prepare students for a life in which technology will play a major role. Today's curriculum must have broadly based transferable skills, making it possible for the students to "communicate and handle information; design, develop, explore, and evaluate models of real or imaginary situations; measure and control physical variables and movement; and be able to make informed judgments with regard to application, and their effect on society." (Atkinson, 1990)

Project UPDATE

The National Science Foundation, in hopes of improving student scores in math and science, funded project UPDATE in 1991. Throughout the country enrollment in "shop" class, or "industrial arts" class, was down. The truth is that enrollment in those traditional "Industrial Arts" classes had been down for years; that trend has been reversed mainly due to the change in curriculum. The time for a change came, and many schools

changed the name of the class to Technology Education, but they did not change very much of the curriculum, and they did not teach the teachers how to change or how to teach this new subject. The result was more confusion in the technology education profession.

One of the current trends in the last few years has been manipulatives and problem solving, taking the hands-off classroom into a hands-on interactive classroom. Administrators and teachers are realizing the importance of hands-on work in keeping the students interested in learning, and improving the learning process. The effect that making a student into an active participant has on learning is being noticed. Technology education is becoming important not only as a contributor to other subjects but also as a subject by itself. The traditional technology education "needs to be combined with D&T and problem solving in order to be successful" (Todd, 2000). Project UPDATE combines traditional technology education, the need for manipulatives, and the need for technology education into a program that teaches it, and ties it in with other subjects.

Technology Making a Difference: The Peakview Elementary School Study

Peakview Elementary School is an innovation in school construction, layout, and administration. The intent was to build a better school from the ground up; an elementary school designed to use technology from the day it opened its doors. Each classroom has computers permanently installed, instead of bringing the students to a room full of nothing but computers. Technology was infused into the daily learning of the students by

adding computer based training and using optical laserdiscs instead of the traditional science, social studies, and math textbooks. That reinforces the idea to the students that technology is a part of everyday life, not just something to go and play with. The administration at both the school, and district level knew that technology costs money, not only up front, but through maintenance as well, and were prepared for that. They also knew that the key to achieving many of the schools goals was found in technology integration. "Technology has changed the way teachers work instructionally and professionally, resulting in a net increase of hours and greater productivity, effectiveness, and satisfaction"(Wilson, Hamilton, Teslow, & Cyr, 1994).

The study was intended to be a snapshot of the conditions at Peakview. They used two comparisons in order to provide a context for understanding:

1. Beginning versus end of school year. The authors collected data in August 1991 (one month after opening), and May 1992 (just prior to the end of the school year).
2. Peakview versus other schools. Three schools within the school district were chosen for comparison. Summit Elementary and Polton Elementary were chosen because they had a centralized computer lab, and very few computers in the classroom. Dry Creek Elementary was chosen because they had computers in the classroom, but they were older models.

A summary of Peakview Elementary shows the overall integration of technology into the school was a complete success. Both teachers and students are positive about

their feelings toward technology. Students are using the technology in problem solving activities. Teachers reported a desire to learn more about technology in order to further integrate it into their curriculum. One of the keys to the success was the supportive district and principal. Some of the recommendations were to continue development thorough teacher training, continue to cultivate parental involvement, and to implement cooperative learning activities. Although this project was mainly centered on implementing computers, it shows that the earlier we introduce technology the better students and people we will produce.

A New Paradigm for Schooling

Headlines across the nation often refer to public schools as failures, with outdated ideas, and equipment. States are adopting standards like the Virginia Standards of Learning in an attempt to improve the quality of education. Dr. Ronald Todd, author of Chapter 7 in the 46th Council on Teacher Technology Education yearbook on Elementary School Technology Education, believes that a paradigm shift in the mindset of educators and administrators is what is needed in order to fix the public school system. That new paradigm is the Design & Technology (D&T) approach where concepts and theory emerge from practice (Todd, 1997). The students will be problem solving using hands-on approaches where the teacher becomes more of a facilitator in the learning process instead of the focal point. The students will no longer need to ask why they are learning something; they will already know.

Curriculum integration is essential to the success of a school adopting the D&T approach. Teachers have been doing it for years with reading being reinforced and taught in science and math class. The problem is that most elementary school teachers are strong in English and Math, but they are weak in science and technology. Integrating technology and science into the other subjects will require supportive instructional materials. Teachers are creatures of habit and like the rest of us, if the instructional materials, and the administration do not support them, they will return to the traditional methods of teaching that they have always used. To alter the concepts taught, and reinforced over many years, "teachers need curricular materials and activities that will provide a form of "scaffolding" that can help them (1) adopt new integrated approaches to teaching, (2) replace inadequate constructs, (3) reshape their conceptions of the school curriculum, and (4) acquire new skills in curriculum development" (Todd, 1997).

Implementing a National Program

A national reform is needed, and Steven Barbato, author of Chapter 8 in the 46th Council on Teacher Technology Education yearbook on Elementary School Technology Education, believes that instead of looking forward, we need to look back, to constructivism. It is an old concept that never really had a foothold in the elementary schools. Constructivism is a hands-on problem solving approach that involves the students in their learning. The problem again seems to be that elementary school teachers know about the constructivist approach, but they do not have the necessary training in order to implement it.

Input was taken from principals, superintendents, and school board members across the country for ways to implement a national program on integration of Elementary School Technology Education (ESTE). The Technology Student Association (TSA) in 1992 created The Great Technology Adventure with those inputs. It is a school-wide program designed to overcome the fears of technology and expose their students to ESTE problem solving. The author states that "Teachers who use this process in their standard curricula facilitate student learning through the technological process: (1) identifying problems, human wants and needs, or opportunities; (2) analyzing technology impacts; (3) investigating possible solutions; (4) selecting a viable solution; (5) prototyping the solution; and (6) testing and evaluating a solution, and communicating it to others" (Barbato, 1997). The Great Technology Adventure is not intended to replace the traditional curriculum, but it is a supplement to it, making ESTE a part of everyday life.

Summary

There is no doubt that technology is a part of everyday life. There is also no doubt that it needs to be integrated into the elementary school curriculum; educators at all levels have been saying this for decades now. Currently our elementary school teachers are not prepared, or used to teaching technology. They will need additional training and materials. Our school budgets keep shrinking, however technology initially, and for maintenance, and upkeep, costs money. Where will it come from, and when will we stop talking about it and start doing it? The problem is that we, unlike the United Kingdom,

have not made it policy at a national level. Project UPDATE is doing now what studies for years have been saying needs to be done. This research is needed to determine if project UPDATE is successful at improving the Virginia SOL scores at the fifth grade level.

CHAPTER III

METHODS AND PROCEDURES

Chapter III contains the methods and procedures used to obtain the information that was used to conduct this study. The study was experimental in nature. This chapter describes the population of this study, and the statistical data obtained from Cooper Elementary School in Hampton, Virginia. The following sections are included: population, research variables, procedures, statistical analysis, and summary.

Population

The population of this study consisted of two groups of fourth grade students at Cooper Elementary School in Hampton, Virginia. One group received design and technology training using the project UPDATE methods and materials for one school year (Group 1). Group 1 included twenty-two students. The other group received the normal fourth grade curriculum, which does not include technological studies, for one school year (Group 2). Group 2 included twelve students.

Research Variables

The students in Group 1 received training in design and technology activities focused on problem solving, using the project UPDATE methods and materials. Group 2 students did not receive any additional training in design and technology that is not normally included in the fourth grade curriculum at Cooper Elementary School in Hampton, Virginia.

Procedures

Project UPDATE methods and materials were presented to the Group 1 students once per day for one hour throughout the year. Teachers trained in the project UPDATE methodology using project UPDATE materials presented the training. Group 2 students did not receive project update training. All Group 1 students who participated in this study were volunteers.

Statistical Analysis

The fifth grade Virginia Standards of Learning scores for Group 1 and Group 2 were collected; the mean scores were determined. The data were then analyzed using t-tests. This was done to determine if there was a significant difference in the Virginia SOL scores between Group 1 that received project UPDATE training and Group 2 who did not receive the additional training.

Summary

Chapter III outlined the methods and procedures used for collection and treatment of this study's data. The topics covered in this chapter were population, research variables, procedures, and statistical analysis. In the following chapter, Chapter IV, Findings, the results of this study's research will be presented with respect to supplying data for the hypothesis designed to guide this study.

CHAPTER IV

FINDINGS

The problem of this study was to compare the Virginia SOL scores of a group of fourth grade students at Cooper Elementary School who had project UPDATE education in design and technology compared to fourth grade students at Cooper Elementary School who did not receive the education. This chapter contains the results of the data that was collected. The data were used to determine if there was a significant difference in the Virginia SOL scores of fourth grade students that received project UPDATE training in technology, with fourth grade students who did not receive the training.

Explanation Of Tables

Group 1, the experimental group, consisted of two fourth grade classes who received project UPDATE education in design and technology throughout the school year. Group 2, the control group, consisted of a fourth grade class who did not receive project UPDATE education in design and technology throughout the school year. t-tests were used to compare the results of the data collected.

There were a total of thirty-four students used in this research. The experimental group had twenty-two students, and the control group had twelve students. One student in the experimental group only took the English and Math portions of the Virginia SOL test. t-tests were used to determine if there was a significant difference in the Virginia SOL scores of fourth grade students that received project UPDATE training in technology, with fourth grade students who did not receive the training. Tables 1-6 show

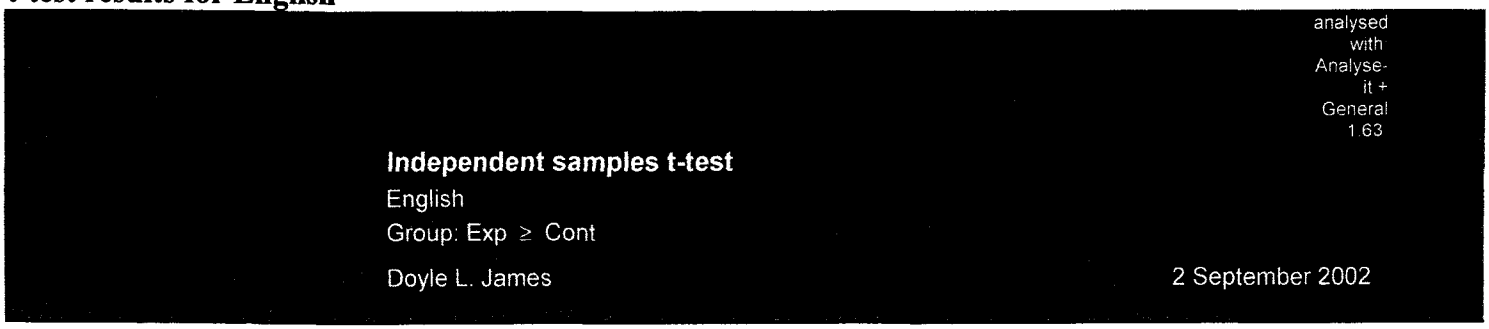
the data for the t-tests conducted. Table 7 shows the Virginia SOL scores for all tests completed by both the experimental and control groups.

English

Table 1 shows the results of the t-test in English. Group 1 consisted of twenty-two students, and Group 2 consisted of twelve students. The mean for Group 1 was 436.9; the mean for Group 2 was 461.3. The standard deviation for Group 1 was 39.1, the standard deviation for Group 2 was 38.2. t was –1.75. At a level of significance of .05, with d_f of 32, t of 1.75> 1.697. The hypothesis is accepted.

Table 1

t-test results for English



n	34

Group	n	Mean	SD	SE
Exp	22	436.9	39.1	8.33
Cont	12	461.3	38.2	11.04

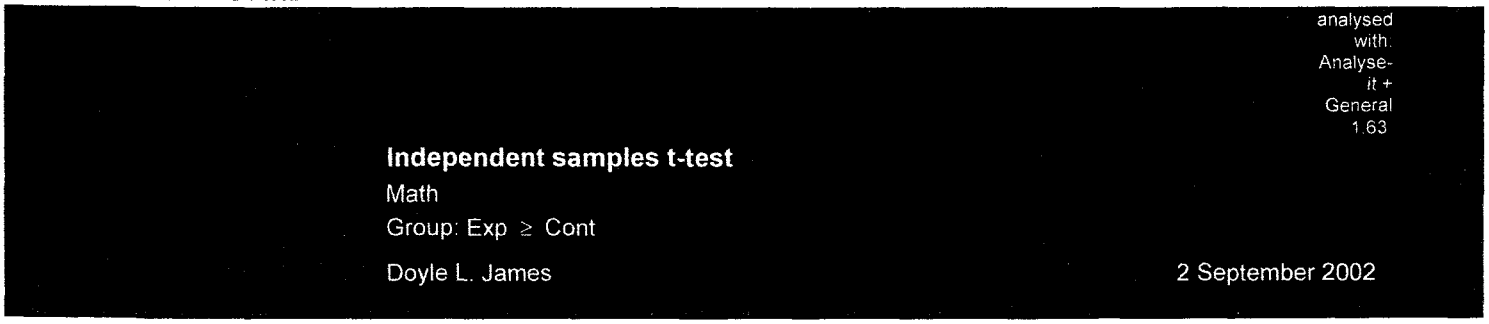
Difference between means	-24.3
95% CI	-47.9 to +∞
t statistic	-1.75
1-tailed p	0.9550

Math

Table 2 shows the results of the t-test in Math. Group 1 consisted of twenty-two students, and Group 2 consisted of twelve students. The mean for Group 1 was 421.909; the mean for Group 2 was 446.417. The standard deviation for Group 1 was 46.475; the standard deviation for Group 2 was 28.079. t was –1.66. At a level of significance of .05, with d_f of 32, t of 1.66< 1.697. The hypothesis is rejected.

Table 2

t-test results for Math



n	34

Group	n	Mean	SD	SE
Exp	22	421.909	46.475	9.9084
Cont	12	446.417	28.079	8.1058

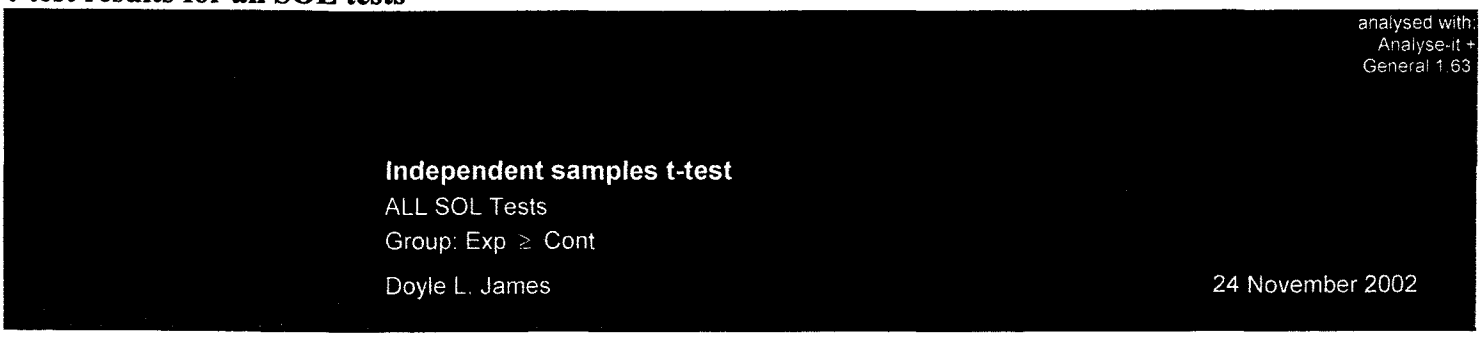
Difference between means	-24.508
95% CI	-49.486 to +∞
t statistic	-1.66
1-tailed p	0.9469

All SOL Scores Combined

Table 6 shows the results of the t-test with all SOL scores combined. Group 1 consisted of twenty-one students, and Group 2 consisted of twelve students. The mean for Group 1 was 434.7; the mean for Group 2 was 454.1. The standard deviation for Group 1 was 44.2; the standard deviation for Group 2 was 33.9. t was –2.94. At a level of significance of .005, with d_f of 165, t of 2.94> 2.576. The hypothesis is accepted.

Table 6

t-test results for all SOL tests



n	167

Group	n	Mean	SD	SE
Exp	107	434.7	44.2	4.27
Cont	60	454.1	33.9	4.38

Difference between means	-19.3
95% CI	-30.2 to +∞
t statistic	-2.94
1-tailed p	0.9981

Table 7

Virginia SOL scores for all tests completed

English

Group Exp	Group Cont
426	433
446	446
529	455
431	465
405	476
455	431
529	431
465	566
431	431
387	465
455	490
455	446
377	
399	
446	
417	
399	
476	
417	
417	
426	
424	

Math

Group Exp	Group Cont
402	433
409	414
515	485
404	485
393	447
449	474
515	414
474	474
474	440
378	409
433	427
433	455
373	
409	
398	
388	
369	
499	
409	
393	
362	
403	

History

Group Exp	Group Cont
377	431
424	418
480	448
418	418
424	448
418	399
517	389
468	468
399	431
383	457
418	431
480	468
362	
372	
411	
517	
394	
457	
439	
417	
399	

Science

Group Exp	Group Cont
393	426
426	449
508	478
491	458
433	426
441	426
468	433
433	458
389	433
407	508
449	491
508	491
378	
378	
372	
449	
384	
449	
433	
458	
426	

Computer

Group Exp	Group Cont
416	440
471	440
522	501
471	471
440	485
471	460
557	401
501	471
460	501
408	471
449	471
501	557
357	
408	
440	
416	
440	
485	
432	
432	
499	

SUMMARY

Chapter IV showed the data that were collected on both groups. t-tests were used to determine if there was a significant difference in the Virginia SOL scores of fourth grade students that received project UPDATE training in technology, with fourth grade students who did not receive the training. Chapter V will provide the Summary, Conclusions, and Recommendations for this study.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

In this chapter a discussion of the results will be furnished, data will be interpreted, and relationships between findings and theory will be discussed. In addition, conclusions to this study will be made, and recommendations for further study into the topic of technology education at the grade school level will be provided.

SUMMARY

The problem of this study was to compare the Virginia SOL scores of a group of twenty-two fourth grade students at Cooper Elementary School who had project UPDATE education in design and technology compared to twelve fourth grade students at Cooper Elementary School who did not receive the education. The hypothesis of this study was that teaching students design and technology using the project UPDATE methods and materials would improve students fourth grade Virginia SOL scores.

The students in both of the fourth grade experimental group classes were told about the program, and they were given the opportunity to transfer to the control group that did not receive the project UPDATE education in design and technology. The experiment lasted throughout the school year, and the Virginia SOL tests were given during the next school year. The SOL test data from both groups was compiled, and t-tests were calculated to determine if there were a significant difference between the two groups in the SOL subjects of English, Math, History, Science, Computers, and a combined subject t-test was completed.

Project UPDATE focused on the development of materials that would support elementary teachers in the efforts to implement a design and problem solving approach to teaching and learning in their classroom. Project UPDATE materials provide teachers with design and technology (D&T) activities that engage students K-8 in active and reflective learning.

Technology is infused into our everyday lives. The focus of this study is to determine if introducing design and technology concepts at the fourth grade level using project UPDATE methodology will improve not just the technology SOL scores, but all of their SOL scores. Answering the questions posed in this paper will hopefully help to bring notice to the need to include technology education in the elementary school level permanently, and eventually make it a core subject instead of an elective.

This study was conducted in good faith; however, the limitations of this study must be considered and were as follows:

1. The results of this study were confined to a fourth grade classes at Cooper Elementary school in Hampton, Virginia.
2. This research did not include observations of the training, but instead it relied on evaluating student performance via post training data.
3. This researcher was not able to supervise students, or document any outside assistance they received in preparing for the Virginia SOL tests outside of the classroom.
4. Students volunteered for the training.

In this study factors believed to be true for all students and teachers involved were as follows:

1. All students in the control group received the same training.
2. The teachers were trained in project UPDATE methodology.
3. The students did not receive specialized training in Virginia SOL preparation as part of the project UPDATE education.

CONCLUSIONS

To solve this problem, the following hypothesis was tested:

H_1: Teaching students design and technology using the project UPDATE methods and materials will improve their fifth grade Virginia SOL scores.

The findings of this study indicated that there was a statistically significant difference in Virginia SOL scores in English and Science with $p>.05=1.697$, the 1 tailed t for English=1.75, and 1 tailed t for Science=1.80. Analysis of the data for Mathematics showed that with $p>.05= 1.697$, the 1 tailed t for math=1.66 which at 94.69% is significant, but not enough to reach the 95% level which would make it statistically significant. Analysis of the data for History and Computers showed that there was not a significant improvement with $p>.05=1.697$, the1 tailed t for History=0.46, and 1 tailed t for Computers=1.05. A combined t-test using the scores from all five SOL tests were completed which showed that with $p>.005=2.576$, the 1 tailed t for the combined score=2.94 which indicated that there was a statistically significant difference in the means of the overall Virginia SOL scores of the experimental group when compared to the control group.

Based on the results of the t-test conducted, the hypothesis: Teaching students design and technology using the project UPDATE methods and materials will improve students fifth grade Virginia SOL scores is accepted for a combined SOL score, English and Science, and rejected for Mathematics, Computer, and History, although Mathematics scores showed improvement in greater that 94% of the cases.

RECOMMENDATIONS

This study was undertaken to determine if Project UPDATE training helped to prepare students for the Virginia SOL tests. The data show that it does help them prepare. Project UPDATE should continue, and grow to possibly become the standard core subject of technology that we have needed at the elementary school level for years. The topic of bringing technology education to the elementary school level in the United States has been discussed for many years. The United Kingdom took the discussion to the next level and implemented technology as a core subject in 1990. The United States needs to follow the leader and implement technology as a core subject at all levels. The question remains what do our students need to know about technology in order to get them ready for life after school?

Further research needs to be conducted to determine how to modify Project UPDATE so that it does improve Virginia, and any other state standardized tests in all areas, or to develop a core Technology subject for the United States to implement at the elementary school levels.

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