2008

The Use or Non-Use of Calculators Affects on Student's Ability to Perform Basic Mathematics Problems

Christina Miles
Old Dominion University

THE USE OR NON-USE OF CALCULATORS AFFECTS ON STUDENT'S ABILITY TO PERFORM BASIC MATHEMATICS PROBLEMS

A RESEARCH PAPER PRESENTED TO THE GRADUATE FACULTY OF THE DEPARTMENT OF OCCUPATIONAL AND TECHNICAL EDUCATION STUDIES
AT
OLD DOMINION UNIVERSITY

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE
MASTER OF SCIENCE DEGREE

BY

CHRISTINA GORDON MILES

AUGUST 2008

APPROVAL PAGE

This research paper was prepared by Christina Gordon Miles under the direction of Dr. John Ritz at Old Dominion University in Norfolk, Virginia. It was submitted to the Graduate Program Director as partial fulfillment of the requirements for the Degree of Master of Science.

APPROVAL BY: _____ Date _____

Dr. John M. Ritz
Advisor and Graduate Program Director

ACKNOWLEDGEMENTS

I would like to especially thank my husband, Captain Paul E. Miles, pilot extraordinaire, in both fighter jets and a Boeing 717, for his review and critique of this manuscript. His many hours of reading, rereading, reviewing and suggestions helped make this thesis possible and presentable. He helped keep me going when pain made me want to quit.

I must also thank my daughter, Beth Ellen, for being there by my side, doing her homework and also attending classes with me, to ease my mind about her safety. Without her encouragement I could not continue.

I need to thank God for the doctors and medicine that has kept me alive to be with my family and continue with this paper.

Finally, I would like to thank Dr. John M. Ritz for the many hours he has spent in reviewing and keeping me focused on the goals of this study. Without his help and guidance, I would not be able to complete this course.

Christina Gordon Miles

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF TABLES

Page

CHAPTER I

INTRODUCTION

Mathematics is one of the most demanding and difficult subjects for a student to master (Devlin, 1996). Mathematics is taught every year from the beginning of elementary education through post-secondary education and in graduate education. Basic mathematic skills are essential to everyday life. From shopping to traveling, "math problems" exist in every aspect of daily living. However, the emphasis placed on mathematics in education and the pervasive nature of mathematics in everyday life are not enough to motivate some students to learn, master, and retain its concepts.

Family and Consumer Science education, commonly known in secondary schools as Teen Living, goes beyond the cooking, cleaning, and sewing of traditional Home Economics courses to expose students to subject areas that are directly applicable to a successful life. Although traditional Home Economics classes no longer appear in secondary schools, classes such as Teen Living remain popular, and are used by educators to emphasize and reinforce the practicality of core subjects, especially mathematics. Teen Living classes involve studying food preparation, money management, business skills, shopping, interior decorating, child rearing, and numerous other topics. Mastering these subjects requires a solid foundation and good basic knowledge of mathematical concepts.

Despite the requirement that students take a mathematics class each year throughout their educational careers, the mastery of mathematics skills in the United States is diminishing (United States Department of Education, 2007). There are several

likely reasons why students are not mastering the foundations of mathematics, with mathematics teaching methods at the center of this debate. Beyond methodology however, technological innovations such as calculators have enabled students to solve mathematical problems without fully mastering the concepts involved. Allowing the use of a calculator during mathematics class reduces the need for the student to learn traditional, and perhaps fundamental mathematical skills, such as the multiplication tables. This researcher will attempt to determine whether or not the use of calculators during mathematics class has negatively influenced the development of basic mathematics skills in eighth grade students, and whether this negative impact has any effect on the students' abilities to perform the everyday tasks taught during Teen Living classes.

Statement of Problem

The purpose of this study was to determine if the use or non-use of calculators in eighth grade mathematics classes affects a student's ability to solve basic mathematics equations in the Teen Living (Family and Consumer Science) class when working with simplistic life skill problems.

Research Goals

The goals of this research paper were to:

1. Determine if the use or non-use of calculators affects student performance in basic mathematics calculations and measurements used in Teen Living classes.

2. Determine how the use or non-use of calculators affects basic mathematics skills.
3. Determine if the use or non-use of calculators affects students who are not allowed to use calculators when given simple life skill mathematics problems.

Background and Significance

Mathematics is the body of knowledge focusing on the concepts of quantity, structure, space, and change. Through abstract reasoning and logic, mathematics has evolved from counting, calculation, and measurement to be integrated into many fields such as science, medicine, economics, and everyday life. The theories within mathematics were developed in order to solve problems associated within commerce, to understand the relationships between numbers, to measure land, and to predict astronomical events (Devlin, 1996).

Today mathematics is integrated into the educational systems of all developed countries. Most schools begin teaching addition and subtraction to students who are between the ages of five and seven years old. Students progress through mathematics courses focusing on different subdivisions of mathematics as they move through the grades in school. By the time the student graduates from high school or any secondary education institution, he will have been taught the major subdivisions of mathematics including algebra, geometry, and calculus (Baroody & Coslick, 1998).

There are many different philosophies on the most effective methods to teach mathematics to students. The traditional method of teacher-led drills and tests are the most widely utilized methods in the United States. However, student-centered teaching

methods are becoming increasingly popular. Each discipline of mathematics has its own set of challenges, and each student will respond to those challenges differently. Utilizing a hybrid version of teacher-led and student-led teaching methods is essential.

Along with reading, mathematics is considered a necessity in any educational system. The No Child Left Behind Act of 2001 created new standards for school accountability towards students. Part of how the schools are held accountable is through mandatory testing of reading and mathematics (The United States Department of Education, 2004). This demonstrates the importance of mathematics as far as the government is concerned. By the government's standards, mathematics is one of two essential parts of any student's education. It is so important that funding for entire school districts can be jeopardized simply by low student mathematics test scores.

Through the No Child Left Behind Act, students are required to take an annual mathematics and reading test every year between the third and eighth grade. Although the act is federally mandated, the standards are set by each state. However, the federal guidelines insist that the state standards be challenging to the student (The United States Department of Education, 2004). Again, this emphasizes the importance placed on mathematics education. By requiring annual testing of a high standard, the government is insisting that schools do not let students slip through the system without achieving a decent understanding of mathematics. President Bush called the Act "the cornerstone of [his] administration" (The United States Department of Education, 2004).

The mathematics drills and memorization of formulas may seem mundane and pointless to a young student. However, these concepts are a vital part of everyday life. Addition, subtraction, multiplication, and division exist in all facets of life including

cooking, shopping, and traveling. These four operations form the basis for the more complex concepts such as algebra, geometry, and calculus. These concepts are used in solving everyday problems, such as determining the discount in dollars of a 30%-off sale, or figuring out how much of a tip to leave for a server at a restaurant. The concepts of geometry are used to complete building problems and determine the quickest route to get from one destination to another.

Family and Consumer Science education, or Teen Living, is the academic discipline that teaches students about nutrition, cooking, parenting, family economics, human development, and other related subjects (American Association of Family and Consumer Science, 2008). Formerly these courses were most commonly known as Home Economics, but today many schools have developed unique names for them, such as Teen Living, to reflect their currency and expanded subject matter. Success in a Teen Living class requires that a student be able to perform solve mathematic problems. The majority of the concepts taught in Teen Living courses integrate mathematics in some form. For example, when learning to cook, a student must know about units of measurement, fractions, and conversion of measurements from one system to another. Learning how to develop a budget and savings plan requires skills in addition, subtraction, and algebra. The concepts taught in Teen Living are certain to be utilized in everyday life, even prior to graduation from the secondary school the student is attending. A deficient level of mathematics skill will negatively affect the student's success in mastering the concepts taught in Teen Living, and by inference, in everyday life.

Throughout history, the invention of innovative calculating devices assisted in expanding the understanding of mathematical concepts. However, at the beginning of the

21st Century, professionals were asking if the calculator had become a debilitating device rather than an enabling device. Utilizing calculators during mathematics class may affect a student's cognitive level of mathematics concepts. The student may not need to learn certain fundamental operations and methods because the calculator will complete these calculations itself. Instead of memorizing multiplication tables for instant recall, a student can simply enter an equation into the calculator and he/she will receive the correct answer. However, it is unlikely that these students will carry a calculator with them at all times of their lives. It is inevitable that at some point, these students will need to be able to perform mathematical operations without the use of the calculator and may be unable to do so.

Many students find it easier and quicker to enter even simple problems into the calculator than to solve the problem in their heads. Some calculators are so powerful that they can perform complex calculus equations and return the correct answer immediately. With prices for electronics constantly falling, the availability of small, fast, and powerful calculators is widespread. Consequently, many students argue that they will have a calculator in one form or another available to them whenever they need. In particular, computers are extremely common at the workplace, and most cellular telephones feature a calculator. Microsoft Excel, along with other spreadsheet software, makes calculations of financials very simple. With all of these powerful tools, why would a student need to learn mathematics without the aid of a calculator?

This study will examine the effects of using calculators on the development of mathematic skills in eighth grade students. The study will focus on the potential negative ramifications of using calculators instead of teaching students the fundamentals of

mathematics. If a student learns to calculate percentages with continuous access to a calculator, that student will most likely be unable to calculate percentages without the assistance of a calculating device. Similarly, this access may limit the student's ability to perform other basic calculations that occur often in everyday life. The study will explain how the concepts taught in Teen Living utilize mathematic calculations, and how these calculations are essential to mastering the skills used while performing everyday tasks. Calculators can enhance the mathematical learning experience, but they can also be a substitute for learning.

Limitations

The limitations of this study were as follows:

1. The study was only conducted with eighth grade middle school students enrolled in Teen Living at Larkspur Middle School in Virginia Beach, Virginia.
2. The study was conducted during the second semester of the 2007-2008 school year.
3. The study was limited to simple mathematics equations utilized in the Teen Living Foods and Sewing Laboratories and in the Teen Living Related Areas class (work, buying, and banking).
4. The varying motivation of participants to accurately complete the mathematical computation worksheet was not measured.

Assumptions

The following assumptions were made concerning this study of middle school Teen Living Education students:

1. It was assumed that the first controlled mathematical computation worksheet completed by the students without the use of calculators was completed to the best of their abilities.
2. It was assumed that the same mathematical computation worksheet completed by the students with the use of calculators one week later was completed to the best of their abilities.
3. It was assumed that eighth grade Teen Living students at Larkspur Middle School should, through prior education, be able to complete the simple mathematical computations used in the Family and Consumer Science Curriculum without the use of a calculator.

Procedures

The subjects of this study were the eighth grade students in the Teen Living classes at Larkspur Middle School. Due to students frequently being unable to complete simple mathematical equations needed in the context of the Teen Living competencies, the researcher wanted to determine if students could only do these mathematical functions when using a calculator. The instrument used for the study was a mathematical computation worksheet developed by the researcher. The responses obtained from the questions were compiled and tabulated to determine whether the goals of this study were addressed.

Definition of Terms

The following terms were used throughout this study:

1. Elective courses – An elective course is a course that is not required for graduation. Career and technical education subjects are usually offered as elective courses.
2. Teen Living – Teen Living is a course that emphasizes the study and application of problem solving, leadership, career interests, and environmental issues. Mathematics, science, language, social science, fine arts, and technology are integrated throughout this course (Virginia Family and Consumer Science State Curriculum, 2004).
3. Life Skill problems – Mathematical problems encountered on a daily basis in a Teen Living classroom.
4. Basic mathematical equations – Simple calculations utilizing the basic mathematical functions of addition, subtraction, multiplication, division, fractions, and percentage.

Overview of Chapters

In Chapter I of this research paper, the mission of Teen Living classes was discussed. The significance of mathematical skills in everyday life was researched. Most mathematic courses allow the use of calculators. The effect of using calculators during math class on the development of mathematical skills in eighth grade students was analyzed. The research problem of determining if the use or non-use of calculators in eighth grade mathematics

classes affects a student's ability to perform percentages and basic mathematics problems in the Teen Living class, conducted during the second semester of the 2007-2008 school year, was discussed. Goals were established and a background of the problem was discussed along with the reason for studying this problem. As in all studies, there were limitations and assumptions made in order to make the study possible before the actual study could be accomplished.

Chapter II will examine literature that is related to this study, establish important variables, distinguish between what has been done and what needs to be done, synthesize and gain perspective, determine and support meaning and relationships, establish the context of the problem, and establish the significance of the problem. Chapter III will discuss the methods and procedures used to conduct the study. Examination techniques used and the procedures for determining the validity and reliability of the study will be explored.

In Chapter IV, the findings of this study will be discussed and analyzed. Finally, in Chapter V, a summarization of all the data gathered during the study will be given and conclusions and recommendations will be proposed from the findings. The study will be analyzed to see if all the goals established at the start of the study were met and what could have been done to help improve the results of the study.

CHAPTER II

REVIEW OF LITERATURE

The debate over calculators in the classroom will continue even as new research becomes available. Since the debate is more focused on how much calculators should be used, rather than whether they are to be used at all, makes interpreting the data very subjective. This gives both sides cause to continue their own crusades for or against calculators. With mathematics sometimes being a difficult subject, being able to use a calculator is very appealing for many. Instead of memorizing lists of formulas, the student can just enter the numbers and operations into the calculator and it will do the work (Lockhart, 2008).

Those who favor calculators recognize how much more material is covered in the classroom because of the use of calculators. Without calculators, it can be difficult to address more complex mathematical materials. Because of calculators, especially graphing calculators, concepts and relationships never before covered in school are now available to students (IBM, 2008). In addition, students are not restricted by the time it takes to perform long calculations. They can perform those calculations and move on to other parts of the problem. This allows more material to be taught and more time to be spent teaching concepts to students. Although the use of calculators can minimize or marginalize mathematics drills, it still allows for more coverage of topics (Klein, 2003).

Opponents of calculators in the classroom take a more traditional approach to teaching the subject. They advocate drills and repetition in teaching. By doing this, the student will more likely remember the mathematics concepts and be able to perform the

calculations without the use of a calculator. Opponents believe these skills will be more beneficial to the student and make him or her a better performer overall (McCauliff, 2004).

Using calculators, according to the opponents, produces students who are dependent on the calculators to perform basic mathematic operations. Without the calculators, these students cannot pass mathematics tests that the generation before them could (Lightner, 1999). Opponents argue that the students are allowed to not be as smart in mathematics because they have calculators to do the work for them (Jehlen, 2008). Although the workplace does allow the use of calculators, there are still many situations where either a calculator is not available to solve a problem, or the problem cannot be solved even with a calculator because the student does not truly grasp the mathematical concept that is needed.

Regardless of either opinion, calculators are in the classroom. What educators need to determine is the extent to which calculators can and should be used in the classroom, such that the students will still fully understand and be able to utilize the fundamentals of mathematics. Many more developments in the field of mathematics have been made. Mathematics is applied to most fields of science. Scientists have found that mathematics has proven crucial in the fields of chemistry, astronomy, and physics. Along with reading, mathematics has become the foundation of all learning.

This chapter is a review of the literature found on the topic of this study. Several different influences affecting the study and teaching of mathematics will be addressed under the following subheadings: Teacher Led Mathematics Curricula, Student Led Mathematics Curricula, Calculators Effects on Mathematics Skills, and Summary.

Teacher Led Mathematics Curricula

Often called Traditional Math, this method of teaching mathematics is the dominant form of teaching. It involves teaching the foundations of mathematics and using those principles to build on other, more complex principles, much like phonics in reading (Klein, 2003). The mathematics instructor teaches these principles and grades students on whether they answer various mathematics questions correctly. These questions are designed to use the principles taught in different forms and combinations. This form of teaching is under the premise that if the student understands the principles then they will answer the questions correctly (Lightner, 1999).

This form of teaching emphasizes drilling students on the principles of mathematics and instilling the concepts through repetition. The result is a lot of mathematics homework for students that repeat the concepts over and over with slight variations. In theory, this repetition will make the mathematical concepts almost second nature to the student (Lightner, 1999).

Although this form of instruction has dominated throughout the 20th century in America, there are many critics. Some believe that this style of teaching stifles any creativity in mathematics and replaces it with repetitiveness and drilling. This makes students lose interest in the subject. Reformists believe that the direct-instruction approaches are doomed to fail (Van de Walle, 1999).

Another complaint has to do with the use of calculators. Reform educators tend to embrace the use of calculators in mathematics education. They believe that the use of calculators will eliminate the redundant but long calculations such as long division. In

addition, it will enable the student to perform more complicated mathematical problems that would otherwise be difficult for the student.

However, traditional mathematics proponents would completely disagree. Many traditionalists believe that calculators take away from teaching the fundamentals of mathematics. With the fundamentals removed, students become more reliant on the calculators and are unable to perform basic math operations on their own. The idea of taking away from basic mathematical concepts attacks the root of how traditional mathematics education works.

Student Led Mathematics Curricula

The student led curriculum in mathematics lasted for only a brief period and was isolated primarily to American education. It began in 1989 with the National Council of Teachers of Mathematics (NCTM) publishing national standards of mathematics for K-12 students. NCTM called this Standards-Based Mathematics (Trafton, Reys, & Wasman, 2001). The premise of the standards was to get away from the logical, right-or-wrong, method of teaching mathematics and focus more on explanation and process. The goal was to teach students more about how to solve a mathematical problem through peer discussion groups amongst the students. Teachers were restricted from participating because the idea was to have the student solve and explain the problem themselves (Klein, 2003).

The new standards laid out by NCTM switched the teaching role from the teacher to the students themselves, reducing the teacher to more of a babysitter (Klein, 2003). By doing this, the students were expected to feel better about themselves and gain a greater

understanding of mathematics because they solved the problems themselves, rather than relying on a teacher to show them. In theory, this would not only make them smarter by grasping mathematical concepts on their own, at their own pace, but would also boost their self-esteem by believing they could solve any math problem (Klein, 2003).

This was an admirable idea but it was ultimately ridiculed by most. People quickly rejected the idea of student led teaching and labeled it one of the worst concepts of teaching ever. In practice, students found the peer time a great opportunity to catch up on the latest gossip.

Calculators Effect on Mathematics Skills

Starting in 1988 and continuing for 15 years, several researchers from Harcourt Assessment, Inc., conducted a study on students to determine if the use or non-use of a calculator made any difference in their test scores. To reduce the chance of errors in the reports, they used the Stanford Achievement Test series and the Otis-Lennon School Ability Test on all subject matters. This prevented any issues with having several difficulty levels in different mathematics tests. The results were taken from students in grades 4 through 12 (Brooks et al, 2003).

Prior to the Harcourt study, the National Center for Educational Statistics (NCES) released their own findings for this question (2001). The study found that students in grade 4 did not perform as well when they used the calculators as students who did not use the calculators. In grade 8, students faired about the same regardless of whether they used calculators or not, and grades 11 and 12 fared better when they used the calculators (NCES, 2001).

There can be some speculation as to the results of the NCES study. Generally speaking, students in grade 4 are still learning the basics of mathematics and the basics of how to use a calculator. They cannot process mathematics problems as quickly as older students can and when they attempt to use the calculator, it only slows them further. Also, the calculator can cause some students to second guess their answers particularly if they are not as confident in their mathematics skills. Students in the middle grades have found a balance in their calculator usage along with their own skills in mathematics. They can determine quickly whether or not they need the calculator and choose appropriately. By the time the student enters grades 11 and 12, they use the calculators to solve problems that are more complicated and therefore use the calculator to help them move through the tests faster and more accurately (Worsley School, 2008).

The first Harcourt study was conducted between 1988 and 1991 and involved the Stanford 8 test. Therefore, the study takes on the name of the test: Stanford 8. This study found almost no difference between students who use and those who do not use calculators. Test results were identical from grade 4 to 7 and then the results were marginally in favor of using a calculator. From that point until grade 12, those students who used the calculators did slightly better than those who did not. Harcourt Assessment concluded that although the difference was small, it was significant. In addition, the difference was enough to justify altering the scoring of the tests based on whether the student took the test with a calculator (Brooks et al., 2003).

The second test, Stanford 9, was conducted in 1995 with a sample size of 2000 students. There were 1000 students from grades 4 through 8 and another 1000 in grades 9 through 12. The results of this test were much different from before. The assessment

team concluded there was no consistent pattern of differences (Harcourt Assessment, 2003). The differences that did show up did not consistently favor one particular group over another. Rather, from one grade to the next, the very minor differences varied between the two groups. Because the differences varied, it was concluded that this pattern was consistent with the conclusion that the calculator use had no effect on group performance (Harcourt Assessment, 2003). It was recommended that no scoring adjustment be made to the Stanford 9 test because the differences were minimal.

The third test, Stanford 10, was conducted in 2002 (National Center for Educational Statistics, 2002). The purpose behind this study was to see if the changes in K-12 curriculum had affected the test scores in regard to using a calculator. Calculator instruction had increased significantly in those seven years and the assessment team at Harcourt believed the study needed to be updated. This study, conducted over the spring and fall of 2002, had roughly 360,000 students participate. Of that study population, 2000 students were selected to take the Stanford 10 test using a calculator. The study found that the differences, like in the Stanford 9 study, were not significant between the two. The only significant differences appeared in grades 9 and 10 where the calculator students scored lower than those who did not use the calculator. As a result, the assessors concluded that scoring between those who used the calculators and those who did not should be the same.

Although the study's purpose was to determine whether the Stanford tests should have the scores adjusted for calculator use, it showed other results by comparing the two groups. One interesting fact was there was no significant advantage for using the calculator or for not using the calculator. From the tests performed during three very

different periods in education, the results did not indicate that having a calculator provided an advantage for students and did not indicate that having a calculator hindered the student's ability to compute math algorithms.

Advocates claim that many studies have confirmed that calculators do not keep children from learning number facts (Jehlen, 2008). Much of the research has been conducted by manufacturers like Texas Instruments and Hewlett-Packard, which can cast some doubt on the accuracy of the studies since these companies have much to gain from the advancement of calculators. Nevertheless, the studies do suggest that students are not being harmed by using calculators.

Summary

Mathematics is used every day. Whether it is an engineer designing a machine, a clothes shopper determining how much he/she will save, or a student in the classroom, all have used mathematical concepts. The importance of mathematics has not diminished. Because of its importance, its presentation to students has become equally important. High-tech calculators can carry out extremely complex mathematical equations in a fraction of a second. This ability has created a debate on whether or not the use of calculators benefits or hurts students in their mathematical understanding.

More specifically the debate is about how much use of the calculator should be allowed in the classroom. There is much debate in the research as to whether it truly helps or hurts students to over-use or under-use calculators (SEDL, 1998). Even with no specific advantage in having a calculator, students could potentially be freed from the drilling of traditional math courses and could expand into different areas of mathematics,

including practical mathematics (such as Teen Living) that cannot be explored without the use of a calculator.

Nevertheless, the use of calculators should be tempered with the understanding that the calculator cannot replace learning mathematics as a subject. Even if students have calculators, they still need to learn the theories to understand how to enter the problem into the calculator. Also, it seems reasonable that students should be able to solve simple mathematics problems in their heads.

This study will attempt to answer that question within a public middle school Teen Living setting. Chapter III will examine the methods and procedures used in this study.

CHAPTER III

METHODS AND PROCEDURES

In order to conduct studies that yield accurate results regarding the success of students in academic subject matter, specific techniques must be utilized. Studies that result in data that can be analyzed statistically are the most effective, because they can provide numerical data that is difficult to dispute and can be most easily explained. The United States Department of Education conducts achievement tests and opinion polls every year in order to obtain statistical data that provides an accurate analysis of the current success of the educational processes used in the public school system, as well as to determine which methods need to be altered in order to produce results that are more beneficial. The National Center for Education Statistics conducts surveys for many different divisions and departments including the elementary/secondary educational institutions. These surveys provide information that allows the government to evaluate the success of public and private education.

In this chapter, the methods and procedures used will be discussed. The research method used was a mathematical computation worksheet and will be discussed further in the following sub-sections: Population, Research Variables, Instrument Design, Method of Data Collection, Statistical Analysis, and Summary.

Population

The population for this study was male and female eighth grade students enrolled in two regular-education Teen Living classes at Larkspur Middle School in Virginia

Beach, Virginia. These students were from several races and cultures. For the purposes of this study, no differentiation was made between these different races or cultures. There were two special education students enrolled in these two particular classes. There were 40 students making up the population.

Research Variables

The independent variable being researched was the use or non-use of the calculator in while performing simple mathematics equations in life skill classrooms. The dependent variable was the proficiency of the test subjects in solving simple mathematics problems by the students as measured by a set of test scores.

Instrument Design

The instrument design chosen was a mathematical computation worksheet that was developed and modeled after standardized tests from the student workbook. It consisted of problems with percentages, subtraction in checking accounts, recipe yield, addition, multiplication, and division problems. It ended with three questions in which the students needed to double recipe ingredients. This worksheet was created to gather the data necessary to measure a student's ability to solve simple life skill problems typical of the Teen Living class, using percentages and basic mathematical operations and skills. See Appendix A for a copy of this worksheet.

The instrument was designed to be given twice, one week apart. The first time the worksheet was completed without calculators and the second time the worksheet was

completed with calculators. Only eighth grade students in Teen Living classes at Larkspur Middle School completed the mathematical computation worksheet.

The instrument began by asking the student to indicate their regular use or non-use of the calculator. If a student was unusually inexperienced with utilizing a calculator, their difficulty in completing the worksheet while using one could skew the statistical results of the study as a whole and act as an outlier during statistical computation.

After the students answered the initial questions regarding statistical placement of their results, the students were instructed to answer the subsequent questions without the use of a calculator and to place their answers in the space to the left of the number of the problem. The students were allowed to conduct mathematical computations by hand on the paper, but were not allowed to use calculators. A week later, the same worksheet was administered to the students and completed with the use of calculators.

Method of Data Collection

Data were collected from the mathematical computation worksheets given to eighth grade students in Teen Living classes at Larkspur Middle School. The mathematical computation worksheet and cover letter (in Appendix B) were given to their teachers, Mrs. Charlotte Beck, Mrs. Linda Daugherty, and the researcher for distribution and collection on May 28 and June 5, 2008. All completed worksheets were returned to the researcher for analysis of the data collected.

Statistical Analysis

The data collected was analyzed by determining the number of correct and incorrect responses to the worksheet on each day. The data were analyzed by determining the number of correct and incorrect responses to each question for both calculator use and non-use. The responses for both were summarized. A t-test determined the significant difference sought in this study.

Summary

This chapter, Methods and Procedures, has stated the methods and procedures used to collect and analyze the data for this study. The eighth grade students enrolled in Teen Living at Larkspur Middle School in Virginia Beach, Virginia comprised the group that was tested. Also identified and discussed were the two variables: the use or non-use of a calculator and the resulting proficiency of the subjects on a mathematical computation worksheet. The design of the mathematical computation worksheet was explained along with how the data would be collected. Since the data were based on points and values, they lent themselves to statistical analysis. In Chapter IV, the findings of the data collection will be shown through statistical analysis, writings, and tables.

CHAPTER IV

FINDINGS

In this chapter, the findings of the study carried out with 40 students at Larkspur Middle School in the eighth grade Teen Living (Family and Consumer Science) classes, working with simple life skill mathematics problems, will be reported. This chapter is composed of the following sub-sections: Introduction, Response Rate, Report of Findings, and Summary.

Introduction

The purpose of this study was to determine if the use or non-use of calculators in eighth grade mathematics classes affects a student's ability to perform basic mathematics equations in the Teen Living (Family and Consumer Science) classes when working with simplistic life skill problems. The instrument used to collect the data for the research was a set of ten questions administered to a class of 40 eighth grade students on two occasions. The first time the questions were given, the students were not allowed the use of a calculator. One week later, the same set of questions were given to the same students allowing the aid of a calculator. All of the questions given were open-ended and involved the employment of simple (for eighth graders) mathematical skills with and without the use of calculators.

Response Rate

All 40 students completed the questions on the mathematics computation worksheet on the dates the questions were administered. There were no absentees, which gave a one hundred percent response rate. The completed instruments were returned to the researcher on June 15, 2008.

Report of Data

The response to the question at the beginning of the mathematical worksheet, "Do you normally use a calculator to do any mathematical equation?" was reported as 38 students replied "yes" and two students replied "no."

The first four questions of the mathematical computation worksheet were story problems, where the student read a commentary of what the problem was and then responded by using their mathematical skills the problem required. The responses to the first four questions are given below.

Question 1, "You are shopping in a store. You see shirts on sale. They cost $30.00 a shirt regularly. The shirts are 30% off the regular price. How much is each shirt?" The responses without the calculator were 26 students answered correctly and 14 students did not. When the students employed the use of a calculator there was not a significant change in the answers. Twenty-eight students responded with the correct answer and 12 students were incorrect.

Question 2, "You are still shopping. You see jeans on sale. They are three pair for $100.00. How much would one pair be?" The responses without the calculator were nine students answered correctly and 31 students did not. When the students used the

calculator there was a significant change in the answers. Thirty-two students had correct answers and eight students were incorrect.

Question 3, "You have a balance of $543.27 in your savings account. You need to take out $267.49 for a new bicycle. How much money will you have left in your savings account?" The responses without the calculator were 18 correct answers and 22 incorrect answers. Once again, there was a significant change when the use of the calculator came into play. With the calculator there were 31 correct answers with nine incorrect answers.

Question 4, "You have baked 4 dozen cookies. You and your friends ate eight (8) of them. How many cookies will you have left?" The responses without the use of a calculator were 25 correct answers and 15 incorrect answers. Once again a significant change took place once calculators were allowed. When the calculators were used, there were 36 correct responses and only four incorrect responses.

The responses to Questions 1 through 4, the story problems without the use of calculators, are shown in Table 1 and responses with calculators in Table 2.

TABLE 1. QUESTIONS 1 THROUGH 4 RESPONSES WITHOUT THE CALCULATOR

Question	*Correct Answers*	Incorrect Answers
Question 1	26	14
Question 2	9	31
Question 3	18	22
Question 4	25	15
Total	78	82

TABLE 2. QUESTIONS 1 THROUGH 4 RESPONSES WITH THE CALCULATOR

Question	Correct Answers	Incorrect Answers
Question 1	28	12
Question 2	32	8
Question 3	31	9
Question 4	36	4
Total	127	33

Questions 5 through 7 of the mathematical computation worksheet were simple column addition, multiplication, division, and linear measure questions. The responses to these three questions follow.

Question 5, was a column addition problem ($293.19 + $77.82 + $715.87 + $18.80 + $7.00). There were 32 correct answers and 8 incorrect answers without the use of the calculator. With the use of the calculator all students were able to attain a correct answer.

Question 6, was a multiplication problem ($210.46 x 12). There were 16 correct and 24 incorrect answers without the use of a calculator and 38 correct and 1 incorrect answer with the use of a calculator.

Question 7, was a division and linear measure problem (504”/12” = how many feet and how many yards). There were 11 correct and 29 incorrect answers without the use of a calculator and 37 correct and 3 incorrect answers with the use of a calculator.

The responses to Questions 5 through 7, the simple column addition, multiplication, division and linear measure questions, without the use of calculators are

shown in Table 3. The responses to the same questions with the use of the calculator are shown in Table 4.

TABLE 3. QUESTIONS 5 THROUGH 7 RESPONSES WITHOUT THE CALCULATOR

Question	Correct answers	Incorrect Answers
Question 5	32	8
Question 6	16	24
Question 7	11	29
Total	59	61

TABLE 4. QUESTIONS 5 THROUGH 7 RESPONSES WITH THE CALCULATOR

Question	Correct answers	Incorrect Answers
Question 5	40	0
Question 6	39	1
Question 7	37	3
Total	116	4

The last three questions (Questions 8 through 10) of the mathematical computation worksheet concerned fractional amounts of ingredients. This type of problem would be found in a recipe where a cook or chef might want to double the recipe.

Question 8 was to double ¼ cup of butter. Five students answered correctly and 35 students answered incorrectly without the use of the calculator. When using the calculator 22 students answered correctly and 18 students answered incorrectly.

Question 9 was to double 2 ½ cups of flour. Sixteen students answered correctly and 24 students answered incorrectly without the use of the calculator. When using the calculator, 35 students answered correctly and 5 answered incorrectly.

Question 10 was to double 1 ¼ tablespoon. Eleven students answered correctly and 29 students answered incorrectly to the question without the use of calculators. When calculators were used, 30 students answered correctly with 10 students answering incorrectly.

The responses to Questions 8 through 10, fractional amounts of ingredients questions without the use of calculators, are shown in Table 5. The responses to the same questions with the use of the calculator are shown in Table 6.

TABLE 5. QUESTIONS 8 THROUGH 10 RESPONSES WITHOUT THE CALCULATOR

Question	Correct answers	Incorrect Answers
Question 8	5	35
Question 9	16	24
Question 10	11	29
Total	32	88

TABLE 6. QUESTIONS 8 THROUGH 10 RESPONSES WITH THE CALCULATOR

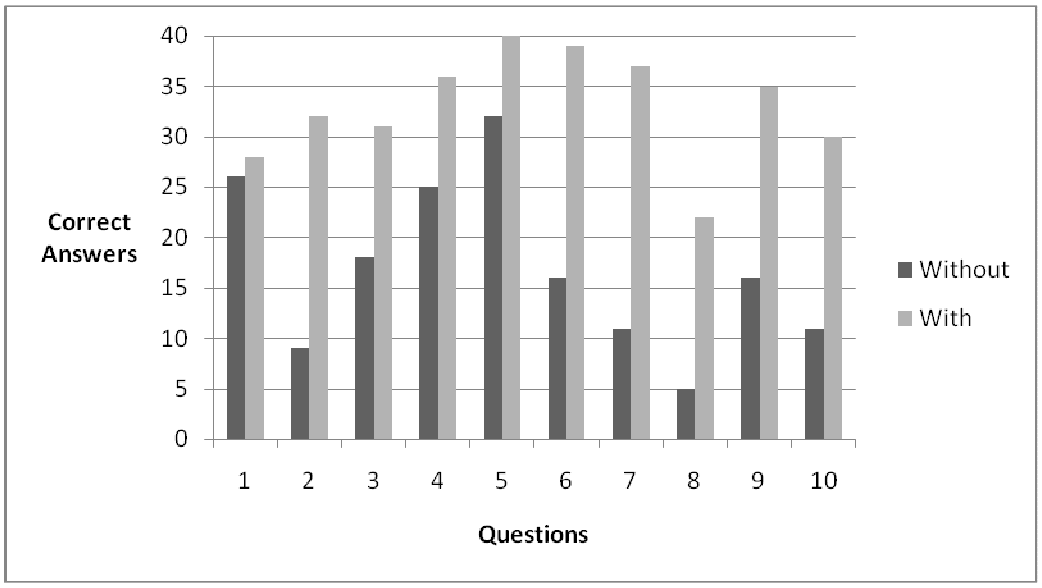
Question	Correct answers	Incorrect Answers
Question 8	22	18
Question 9	35	5
Question 10	30	10
Total	87	33

An analysis of the results show that Question 1 was a very easy question while Question 7 was one of the more difficult ones. This is evident from the fact that there was only a slight difference in the correct answers on Question 1 obtained without or with a calculator (26 out of 40 correct answers or 65 percent, without the calculator and 28 out of 40 correct answers or 70 percent, with the calculator), while there was a significant increase in Question 7 correct answers when the use of the calculator was applied (11 out of 40 correct answers or 27.5 percent, without the calculator and 37 out of 40 correct answers or 92.5 percent, with the calculator). A summary of all questions can be found in Table 7, which shows a graph of the answers in relation to the questions both without and with the calculator. It should be understood that both tests were given to the same sample of students.

A t-test was used to analyze the two sets of scores attained from the research instrument. With a sample size of 40 students for each group, we will use the normal-curve value of 1.684 (.05) percent and 2.423 (.01 percent) to determine the significance of the difference. Since the obtained t-ratio of 4.7 exceeds 2.423, we can assume that the observed difference between the means is significant at the .01 level of significance. This

shows that students who do use calculators score better on simplistic mathematical equations than if a calculator is not used.

TABLE 7. QUESTION RESPONSES COMPARISON GRAPH



Summary

In this chapter, the responses given to the instrument used for this study were shown. The purpose of this study was to determine if the use or non-use of calculators in eighth grade mathematics classes affects a student's ability to perform basic mathematics equations in the Teen Living (Family and Consumer Science) classes when working with simplistic life skill problems. In order to accomplish this task, an instrument was developed to acquire the information sought. The instrument used was composed of ten questions and administered to forty students. The results of the mathematical equation worksheet were examined in this chapter using narrative and tables. The tables were sub-

divided into Without Calculators and With Calculators. This information was also used to supplement the tables and explain the information. In Chapter V, Summary, Conclusions, and Recommendations, the results of the study can be summarized and conclusions and recommendations will be made based on the findings of this study.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

This chapter will summarize the information contained in this research, draw conclusions, and make recommendations for future studies. This chapter will contain the following sections: Summary, Conclusions, and Recommendations.

Summary

The purpose of this study was to determine if the use or non-use of calculators in eighth grade mathematics classes affects a student's ability to perform basic mathematics equations in the Teen Living (Family and Consumer Science) class when working with simplistic life skill problems. The research goals of this study were to:

1. Determine if the use or non-use of calculators affect student performance in basic mathematics calculations and measurements used in Teen Living classes.
2. Determine how the use or non-use of calculators affects basic mathematics skills.
3. Determine if the use or non-use of calculators affects students who are not allowed to use calculators when given simple life skill problems.

The study was focused on finding whether a significant difference existed in completing mathematical problems if a calculator was provided vice if the calculator were not allowed. As in all studies, there were limitations that could affect the outcome of the findings. The following limitations were established for this study:

1. The study was only conducted with eighth grade students at Larkspur Middle School in Virginia Beach enrolled in Teen Living.
2. The study was conducted during the second semester of the 2007-2008 school year.
3. The study was limited to simple mathematics equations utilized in the Teen Living Foods and Sewing Laboratories and in Related Areas (work, buying and banking).
4. The varying motivation of participants to accurately complete the mathematical computation worksheet was not measured.

The instrument used to collect the data for the study was a mathematical computation worksheet consisting of ten questions administered to 40 students on two occasions. The first time the students were not allowed the use of a calculator and the second time the students were allowed a calculator. All of the questions given were open-ended questions that involved the use of mathematical computation.

The data collected from the instrument were compiled. These categories were answers to questions without calculators, answers to questions with calculators, test score numbers, and a t-test to determine if there was a significant difference.

Conclusions

The findings from the mathematical computation worksheet were analyzed and compared to the goals initially established in this study and are reported.

Goal 1. Determine if the use or non-use of calculators affect student performance in basic mathematics calculations and measurements used in Teen Living classes. In order to

determine if the use or non-use of calculators affect student performance, a t-test was performed. With a sample size of forty (40) for each group, the normal-curve value of 2.423 (.01 percent) was used to determine the significance of the difference. Since the obtained t-ratio of 4.7 exceeds 2.423, the observed difference between the means is significant at the .01 level. This study concluded that students who do use calculators perform better than those students who do not use calculators when performing basic mathematics equations in the eighth grade Teen Living (Family and Consumer Science) class, when working with the simplistic life skill problem used in the instrument.

Goal 2. Determine how the use or non-use of calculators affects basic mathematics skills. When the students were using the calculator, they did not have problems completing the mathematical computation worksheet. When the students were denied the use of a calculator, it took more time to complete the test and the students were unhappy about not being able to use calculators. The students took 37 minutes for all students to complete the test without calculators and 14 minutes with the calculators. The results of this small study showed that students do rely on a calculator to do the most simple of mathematics computations. Furthermore, the same students do not know if the calculator-derived answer is correct, as illustrated in the test percentages showing a significant number of wrong answers even using a calculator. These results and observations do not quantify exactly how the students' basic mathematics skills were affected, but they indicated that in some way they were by their inability to proceed through the problem without a calculator. This question thus requires further study.

Goal 3. Determine if the use or non-use of calculators affects students who are not allowed to use calculators when given simple life skill problems. Overall, the group of students studied performed poorly without a calculator. This is reflected by 169 correct responses out of 400 possible answers or 42.25 percent without the use of a calculator compared to 330 correct responses out of 400 possible answers or 82.5 percent with the use of a calculator.

At the beginning of the mathematical computation worksheet, the question, "Do you normally use a calculator to do any mathematical equations?" was asked. The response was 38 students said "yes" and two students said "no." This small sample size does not allow a meaningful conclusion about the efficacy of avoiding calculator use for everyday problems. This presents a question that should be expanded upon in future studies since it appears that most students today do rely a great deal upon an electrical instrument even for simple answers.

Lack of motivation on the part of students was listed as a possible limitation of the study. This was not observed but cannot be excluded. Although the mathematical computations should have been simple to comprehend, it is possible that some of the students may have faced comprehension difficulty.

Therefore the use or non-use of calculators does affect a student's ability to perform basic mathematics equations in the eighth grade Teen Living (Family and Consumer Science) class, when working with the simplistic life skill problems used in the instrument. The students proved more successful solving simple life skill mathematical problems using a calculator.

Recommendations

A strong recommendation would be to encourage other researchers to use this study to devise more research to examine the results documented in this study. More time could be put into conducting follow-up interviews on how students felt about the use of calculators and how their usage affected them personally. In particular, some means for differentiating students who consider themselves less dependent on calculators should be determined, and whether such an ability is truly beneficial in Teen Living education. This would be difficult and time consuming but worthwhile for information needed in teaching mathematics in the future and on the effects of calculator usage.

Overall, the study has met the established goals, but further and more comprehensive research needs to be done to see if the results hold true for a larger population. This population was a class of 40 eighth grade students of the Teen Living (Family and Consumer Science) class at Larkspur Middle School in Virginia Beach, Virginia. If the same study is carried out in a different class, or perhaps a different school with a different age level, it will add to the results from this study. Hopefully this information will benefit future researchers on whether or not the use or non-use of calculators greatly affects the skill of eighth graders to solve simplistic mathematical equations.

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APPENDICES

Appendix A – Mathematics Computation Worksheet

Appendix B – Cover Letter to Teacher

Appendix C – Raw Data from Surveys

APPENDIX A

Mathematics Computation Worksheet

Research Mathematics Worksheet

The purpose of this worksheet is to determine if the use or non-use of calculators in eighth grade mathematics classes affects a student's ability to perform percentages and basic mathematics problems in the Teen Living (Family and Consumer Science) class when working with simplistic life skill equations. Your answers on this worksheet will be beneficial in determining the outcome of this study.

Do you normally use a calculator to do any math equations? YES NO

Directions: Answer each question to the best of your ability. Place your answers in the space to the left of the number of the problem. You may use your paper to work on. Thank you for your help in this study.

_____ 1. You are shopping in a store. You see shirts on sale. They cost $30.00 a shirt regularly. The shirts are 30% off the regular price. How much is each shirt?

_____ 2. You are still shopping. You see jeans on sale. They are three pair for $100.00. How much would one pair be?

_____ 3. You have a balance of $543.27 in your savings account. You need to take out $267.49 for a new bicycle. How much money will you have left in your savings account?

_____ 4. You have baked 4 dozen cookies. You and your friends ate eight (8) of them. How many cookies will you have left?

5 – 7. Answer the following equations. Place your answers at the bottom of the equations.

$293.19
77.82
715.87
18.80
+ 7.00

$210.46
x 12

504" / 12" =_____feet =
_____yards

Answer:_____

8 - 10. Below you will find a table of ingredients. Double the amounts of the ingredients in the spaces to the right on the table.

Ingredients	Double Amount
¼ cup butter	
2 ½ cups flour	
1 ¼ tablespoon	

APPENDIX B

Cover Letter to Teacher

Mrs. Christina G. Miles
3160 Little Haven Road
Virginia Beach, Virginia 23452

April 17, 2008

Dear Mrs. Beck,

I am conducting a research study to determine the effect of calculators on life skills mathematics as practiced in the middle school Teen Living curriculum. This study is in partial fulfillment of the Masters of Science in Education Degree at Old Dominion University. The data that I am requesting through the attached mathematical worksheets will not be published and will only be used for fulfilling the requirements of the Methods of Research in Education class I am enrolled in.

As you know, I work in the Larkspur Middle School Teen Living Department and our eighth grade students are the populace that would fulfill my research as they utilize everyday mathematical computations needed to conduct requirements in everyday life such as banking, measuring and computing percentages. The worksheet should take no more than ten to fifteen minutes to complete. It would be done twice, once without and once with calculators which are available in the classrooms. The instructions to complete the worksheet are simple. The student just needs to answer the mathematical problems to the best of their ability. When the worksheets are completed, please return them to me in the Larkspur Middle School Teen Living office.

Thank you and your classes for your help and assistance with this project. If you have any questions, please feel free to contact me at either 757-463-1019 or 757-572-4599 or while in the school building.

Sincerely,

Christina G. Miles
Larkspur Middle School
Teen Living Teacher

APPENDIX C

Raw Data

Test Results

The question at the beginning of the test: "Do you normally use a calculator to do any mathematics equations?"

Out of the 40 students questioned:

38 said "yes"

2 said "no"

Test question results are as follows:

Without Calculators

Question Number	Correct Answers	Incorrect Answers
Question 1	26	14
Question 2	9	31
Question 3	18	22
Question 4	25	15
Question 5	32	8
Question 6	16	24
Question 7	11	29
Question 8	5	35
Question 9	16	24
Question 10	11	29
Total	169	231

With Calculators

Question Number	Correct Answers	Incorrect Answers
Question 1	28	12
Question 2	32	8
Question 3	31	9
Question 4	36	4
Question 5	40	0
Question 6	39	1
Question 7	37	3
Question 8	22	18
Question 9	35	5
Question 10	30	10
Total	330	70

Scores of the 40 students on both the tests:

Test Score Percentages by Student

With Calculators	Without Calculators
90	70
90	70
90	60
80	70
80	60
90	50
80	50
80	50
70	40
70	40
60	30
50	30
100	30
90	40
90	30
70	50
100	60
90	20
90	30
80	70
100	80
90	60
100	80
90	60
90	80
90	70
80	60
70	70
80	70
100	80
90	80
100	80
90	80
80	70
90	70
90	80
100	80
90	70
90	80
100	90

t-test Results

With Calculators = 86.25			Without Calculators = 61.0		
100	13.75	189.06	90	3.75	14.06
100	13.75	189.06	80	-6.75	-39.06
100	13.75	189.06	80	-6.75	-39.06
100	13.75	189.06	80	-6.75	-39.06
100	13.75	189.06	80	-6.75	-39.06
100	13.75	189.06	80	-6.75	-39.06
100	13.75	189.06	80	-6.75	-39.06
100	13.75	189.06	80	-6.75	-39.06
90	3.75	14.06	80	-6.75	-39.06
90	3.75	14.06	80	-6.75	-39.06
90	3.75	14.06	80	-6.75	-39.06
90	3.75	14.06	70	-16.25	-264.06
90	3.75	14.06	70	-16.25	-264.06
90	3.75	14.06	70	-16.25	-264.06
90	3.75	14.06	70	-16.25	-264.06
90	3.75	14.06	70	-16.25	-264.06
90	3.75	14.06	70	-16.25	-264.06
90	3.75	14.06	70	-16.25	-264.06
90	3.75	14.06	70	-16.25	-264.06
90	3.75	14.06	70	-16.25	-264.06
90	3.75	14.06	70	-16.25	-264.06
90	3.75	14.06	60	-26.25	-689.06
90	3.75	14.06	60	-26.25	-689.06
90	3.75	14.06	60	-26.25	-689.06
90	3.75	14.06	60	-26.25	-689.06
90	3.75	14.06	60	-26.25	-689.06
90	3.75	14.06	60	-26.25	-689.06
80	-6.25	-39.06	50	-36.25	-1314.06
80	-6.25	-39.06	50	-36.25	-1314.06
80	-6.25	-39.06	50	-36.25	-1314.06
80	-6.25	-39.06	50	-36.25	-1314.06
80	-6.25	-39.06	40	-46.25	-2139.06
80	-6.25	-39.06	40	-46.25	-2139.06
80	-6.25	-39.06	40	-46.25	-2139.06
80	-6.25	-39.06	30	-56.25	-3164.06
70	-16.25	-264.06	30	-56.25	-3164.06
70	-16.25	-264.06	30	-56.25	-3164.06
70	-16.25	-264.06	30	-56.25	-3164.06
70	-16.25	-264.06	30	-56.25	-3164.06
60	-26.25	-689.06	30	-56.25	-3164.06
50	-36.25	-1314.06	20	-66.25	-4389.06

$t = 4.7$

With a sample size of forty (40) for each group we will use the normal-curve value of 1.684 (.05 percent) and 2.423 (.01 percent) to determine the significance of the difference. Since the obtained t-ratio of 4.7 exceeds 2.423, we can assume that the observed difference between the means is significant at the .01 level of significance. This shows that students who do use calculators score better on simplistic mathematical equations than if the calculator is not used.