Applied Mathematics

and It's Positive Effects

A Special Project

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ABSTRACT

State testing that requires students to pass a test to graduate has become a very important point on the agenda of all schools. Mathematics being one of the key problems students have tried to overcome. The purpose of this study was to find out if Applied Mathematics helps students retain the skills needed to go out into the future. The students were tested on September 3, 2009 and re-tested on November 3, 2009. In between these two dates one class of students received curriculum from the Applied Mathematics books and the other class stayed with the Algebra curriculum that has been taught in the past. The tests were graded and the difference in the scores was entered into an independent t test. These values produced a degrees of freedom and a t value that led to finding of the distribution of t. These values showed there was significance at 95% that the applied mathematics curriculum was successful in helping students understand the basic mathematics needed by juniors and seniors.

FACULTY APPROVAL

Applied Mathematics and It's Positive Effects

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TABLE OF CONTENTS

Page

Page

Page

LIST OF TABLES

Page

CHAPTER 1

Introduction

Background for the Project

In order to survive and thrive in school, students needed to fully comprehend mathematical concepts. Many students taught in traditional ways did not succeed in mathematics. As a result, resourceful teachers turned to alternative ways of presenting mathematical theories. The alternative ways, which used hands on methods, were identified as applied mathematics. Through careful instruction using applied mathematics, students were able to comprehend theories needed for success in mathematics. The success in using the hands on method provided a basis for success in a any career.

Clearly, mathematics provided a foundation to effectively function in everyday life. Adults exhibited mathematical skills in a variety of daily activities including: calculating a bank balance, determining the greatest value for purchasing necessities, and counting correct change. The mathematical functions necessary for daily life were important for every job available in the world. Even a farmer who calculated the amount of pesticide necessary for spraying ten ounces an acre exhibited competency in mathematics. Administrative assistants utilized mathematical concepts as the budget was balanced for an executive meeting. In every job, mathematics provided a framework for a successful teaching career.

At an early age the writer discovered that not all students learned to apply mathematics in similar ways. In the process of assisting classmates throughout high school, the writer found a variety of alternative instruction techniques that students understood. The process of providing critical instruction to peers led the writer to a career in mathematics. The writer of the Special Project has found that through information on the internet and personal experience in the classroom retention of mathematics was much higher when hands on teaching was been applied. Hands on mathematics has even been proven in biology to help students in college do better on test scores. (McManus, Dunn, Denig, 2003)

Mathematics has been a very important tool that has been used in every facet of our life. In a high technology world to keep up in the world market, understanding math was a key component. The biggest problem with students not only needing to understand mathematics, was that students needed to be able to apply the mathematics to something real. "In the real world, if you cannot understand what it is you are trying to solve, you can't solve it very well." (Harry T. Roman, 2004)

Statement of the Problem

The majority of Washington students experienced failure in mathematics. In 2008, 51.8% of those tested passed the WASL. Clearly, students struggled with mathematics. Many students were not able to learn mathematics because it was presented in a way that did not suit all learners. Students needed to see

mathematics in an alternative form. Students needed to experience mathematics with their hands.

Purpose of the Project

The purpose of the study was to determine the impact of Applied Mathematics on the instruction of high school students at River View High School. The study was to find out if students that had been struggling with mathematics in past years succeeded and retained mathematical skills through Applied Mathematics.

Delimitations

Students experienced Applied Mathematics curriculum during the months of September through November of 2009 at River View High School. The students had only been taught using traditional techniques, such as solving problems that dealt with numbers, letters and equations. The curriculum the students had experienced with mathematics was only numbers and equations used to create more numbers and equations. The students had little experience putting the mathematical concepts to use in everyday life.

The students in the experiment using the Applied Mathematics for the two months experienced material used in the real world. For example, one of the problems the students were challenged with was finding the amount of paint needed to cover the inside of a shop with three garage doors and two walk in doors. Another example was finding how many different colored M&M's were in

a certain size bag. With that number the students were to find what fraction of the bag that color represented, then with the team they were set up with, find the fraction of colors as a team of all the bags put together. Problems and labs like these were what the students went through on a daily basis. Solving problems such as these let the students know how mathematics was useful in everyday life.

The students varied in ages from 15 to 18. Along with a variety of ethnicities being represented, there were also a variety of interests among the students. The students varied from students being involved in sports, student government, computer geniuses, and some who disliked everything about school. The one thing all of the students had in common was that none of them had passed the WASL. Not passing the WASL made the young adults all equal in that they needed to work on understanding mathematics at the High School level. The instructor did not know the students prior to the first day of school.

Assumptions

Students in the applied mathematics class experienced difficulty understanding the basic concepts of mathematics. Assumptions included the correct placement of students in the appropriate level for the Applied Mathematics class. Assumptions also included the fact that students possessed the appropriate background knowledge necessary for success in the class. Also it was assumed the teacher had competency in utilizing the Applied Mathematics instructional materials.

Research Question

Do students who experience instruction through applied mathematics experience a positive impact as shown by the students' ability to apply what was learned to a real world scenario? Were the students more knowledgeable by experiencing the mathematics they already should have known in a new way? Did this new way of using the mathematical concepts in situations applicable to the real world help them in retaining the information?

Significance of the Project

The author's research on Applied Mathematics provided a useful resource for mathematics teachers in Washington State as instructional material committees evaluated the possibility of including Applied Mathematics in scheduling options. The results of the study effectively changed the mathematics experience for struggling students who had not experienced success in mathematics. Additionally, experience in Applied Mathematics changed student perception of mathematics instruction. River View High School, and the local school board, had adopted the Applied Mathematical curriculum but wanted more detailed information on how this curriculum helped students. The pertinence of the project included the fact that local schools needed information on whether or not to offer Applied Mathematics courses. Surveys of Washington students experience with Applied Mathematics were limited. The goals of the study were

to collect information on experience of students in Applied Mathematics course and report the results to the school mathematics department.

Procedure

The sample included high school students and involved twenty-six students between the ages of fifteen and eighteen. The sample included all students in Applied Mathematics. The sample involved students without prior experience in applied mathematics. Instruction using Applied Mathematics technique took place during the months of September thru November 2009. The instructor led students through the instructional materials and facilitated six mathematics labs during the study. The researcher contacted the mathematics department chair and school principal to ensure cooperation with the study. The instructor provided class time to complete the Applied Mathematics units and survey. A personal request for a cover letter to parents was made to the school principal to introduce the research and request cooperation (Appendix A). A sample cover letter was provided as an example. Letters were sent home with students to inform parents regarding the research. The researcher presented the research plan to the school board in order to ensure administrative support. The school principal sent a copy of the final draft to the mathematic department chair at the completion of the research.

Acronyms

CTE. Career & Technical Education

WASL. Washington Assessment of Scholastic Learning

NCTM. National Council of Teachers of Mathematics

CHAPTER 2

Review of Selected Literature

Introduction

Teaching mathematics in our school systems has become a huge dilemma. The dilemma was because "39% of high school seniors are not performing at a basic level in mathematics" (National Council of Teachers of Mathematics, 2000).

The effects of that scenario caused great debate on how teachers should be teaching and what teachers could have done to change the scenario. Math anxiety was something looked at with great emphasis. This was looked at so closely because teachers and administrators were starting to see students dealing with a great deal of stress when mathematics came up compared to other subjects. Anxiety was looked at from the point of how mathematics was being taught compared to how mathematics was being discussed around the student. The influence adults have on children when it came to mathematics had a great effect on how the student perceived new work in the classroom.

The second area of study which was looked at and researched was the future of mathematics. The world was full of technology and computers, and with computers came mathematics. The job market was growing and with that market so was the need for mathematics. One example was the construction industry, which listed as a high growth industry and was expected to create nearly one million new jobs between the years 2006 and 2016, an increase of 14 percent.

The big issue when looking at the future of mathematics was were we going to be able to fill those jobs with qualified applicants that could handle the mathematics required for the position.

The third area that was looked at and researched was Applied Mathematics in our school system. Through research, the education industry discovered hands on mathematics was something which was working and being supported. This was supported by the government through items such as the Perkins Fund and the Hatch Act of 1887 which brought on agricultural experiment stations, scientific research, and the cooperative extension service.

Math Anxiety

When students sat down to a mathematics test the students in a traditional mathematics course remembered formulas to answer the questions. Applications of mathematics were typically not evaluated. Most students did not comprehend the mathematics concepts in the equations. Students simply executed the formula. (Russell, 2008).

Students overcame anxiety from past experiences in mathematics when the student was shown a new applied method. Applied Mathematics had students relate common mathematical equations to real life situations. Concepts were shown to the student in multiple ways in order to maximize comprehension.

Furner and Duffy (2002) found that, "the dread of mathematics can interfere in solving mathematical problems in the academic situation and in the

works of everyday life" cited by Edelmuth. In the 1970's researchers discovered the effects of math anxiety. The researchers found the student's inability to do mathematics due to anxiety was mental and not linked to their intelligence.

Tobias (1993) was one of the early researchers discovering the block in the student's ability to be successful at mathematics was anxiety and not their intelligence. Before Sheila and a few other researchers documented their discoveries it was believed that, "mathematics achievement was not urged for every student, but only those who showed a good aptitude for it" (Tobias, 1993, p.11).

Tobias (1993) explained about the myth of the 60's and 70's, the only students to excel in mathematics were males, because males had the math gene. Women who made it into the collegiate world were pushed out away from mathematics and told because they didn't have the gene it would be better if they did something else. Tobias, (1993) through research, found out by the late 1980's researchers had found, "gender differences in mathematics performance are predominately due to the accumulated effect of sex-role stereotypes in family, school, and society" (Tobias, 1993, p. 72). Since the discovery of women being good at mathematics was not a genetic issue, women have come into the job industry and become very well known for their skills in engineering, science, and mathematics.

Owens (1993) through research found out that in the 1990's, it was still recommended that, " teachers, parents, and counselors…provide more encouragement for girls and other students who are less confident in their ability to learn mathematics" (Owens, 1993, p.28). In 1995 it was found through research the female attitude towards mathematics had improved. Females were still learning to deal with the lack of confidence due to anxiety and the society standard that women were not able to do mathematics.

Edelmuth (2003) determined through studies reiterated the fact that anxiety dealing with mathematics has been an ongoing problem. Even though society as a whole was dealing with gender issues mathematical anxiety was a problem and was something parents, administrators, and teachers were working with on a continuous basis.

Rossnan (2006) talked about how mathematic anxiety has affected children's ability to succeed in their education and their adult life. "Since math is connected to so many professional and personal practices, it is important that we as educators and parents help children to overcome their math anxiety so they can learn the math skills that they need to succeed (Rossnan, S. 2006). Rossnan (2006) went on to say that her child was coming home saying the same things Rossnan (2006) used to say, "she was just not good at math". When Rossnans (2006) daughter said this it, it made her think that she was part of the reason her

daughter thought that way. She discussed the parents' responsibility of being a positive role model, so children didn't have math anxiety issues like we did.

"The Merriam Webster defines anxiety as an abnormal and overwhelming sense of apprehension and fear often marked by physiological signs (as sweating, tension, and increased pulse), by doubt concerning the reality and nature of the threat, and by self-doubt about one's capacity to cope with it" (Rossnan S. 2006)

Rossnan (2006)determined through her research nearly two-thirds of American adults had a hatred and deep fear of mathematics. Rossnan continued to say that a lot of this deeply rooted fear of math was often comprised from the student's first experience with institutional mathematics.

Research by Baroody and Costlick (2006) illustrated how children that developed math anxiety at a young age usually fell into a self-defeating, self-perpetuating cycle that got worse not better. The long term effects of these behaviors led the children to have anxiety which leads to a protective behavior.

Many adults, teachers included, had negative feelings towards mathematics and when they shared their personal views with the children this led to the child carrying on with these same beliefs. Marilyn Curtain-Phillips (1999) research stated that there were three practices that cause great anxiety:

1. Imposed authority
2. Public exposure
3. Times deadlines

(Curtain-Phillips M. 1999)

Math anxiety was an issue many dealt with on a daily basis and the anxiety issue was something many researchers have investigated to find answers to the problem. Rossnan (2006) noted that Furner and Berman listed measures to help students have positive experiences with mathematics. Some of the measures were:

1. Make mathematics enjoyable
2. Show the use of mathematics in careers and everyday life
3. Adapt instruction to students' interests
4. Provide successful activities

(Furner & Berman 2003)

These were activities students could comprehend. Since the students comprehended the activities, they had a positive effect on the students.

Mathematics and The Future

Mathematics was used in everyday life. To get a high paying job in the high technology world students needed a solid foundation in mathematics. "Mathematics is nevertheless, the bedrock of our modern world." (Roman H. 2004) When we looked at mathematics in the work place, mathematics was revealed as common to nearly everything. For example it was common in automobiles, airlines, and the computers that ran our lives.

For students looking for employment anywhere in industry the students were required to not only understand mathematics but also be able to apply mathematics to their specific job. A job application was not the only place that students needed mathematical skills, the student's lifestyles demanded it. The high standard of living enjoyed required a variety of tools to help us understand the world. (Roman H. 2004). The human race was in high demand for a high standard of living that involved high technology. Students were involved in all the technology they could get their hands on. Comparing what students know now to what adults knew 20 years ago, a huge difference could be seen in what students did with technology. What the students did not know was that these young adults were using mathematics that either made the technology or supported it. For a world to keep furthering itself into the world of technology and having the man power to make sure this will get done, the students of today had to be able to apply mathematics to everyday life. The only way today's students were able to compete in the future and succeed with technology was that they were able to do the mathematics. The student must be able to apply it to some type of skill needed to help the young adult in the job market.

Mathematics was a fundamental part of our daily lives, thus mathematics as a part of the students daily curriculum was crucial. As students moved through the school system the teachers did not go a week without hearing," When am I ever going to use this stuff?"(Mohr C. 2008, p.1) The students were talking about

something, having havin no idea what was coming around the corner. The stuff the students were talking about was getting ready to smack the students in the face when they left school and walked into the real world. Along with students not wanting to learn mathematics in the school systems, dropouts were a problem "Approximately 2,500 students dropping out of U.S. high schools every day," (Cory Mohr, 2008).

For a lot of student's high school was the primary institution for the student's formal education. When the students left school and went into the work force the young adults needed the necessary mathematical education to survive in the work force. For the students to survive in the work force the teachers educating the young minds must have instilled the necessary mathematic skills for one to succeed. One example was the construction industry, which for the past few years had been listed as a high growth industry and was expected to create nearly one million new jobs between the years 2006 and 2016 an increase of 14 percent. (U.S. bureau of Labor Statistics, 2006) (Mohr C. 2008) For the young individuals to succeed the students needed to be able to apply mathematics to the certain career path the young adults were interested in.

When the Bureau of Labor Statistics went out to find just what it took to be in the carpentry industry the Bureau found out that a big part of the carpenters work day involved mental mathematics. The mathematics used frequently " was making estimations, trigonometric and geometric ratios and functions,

Pythagorean Theorem, sine, cosine, tangent; calculate the perimeter and area of a triangle, rectangle and circle and the volume of a pyramid, rectangular prism, and sphere; and use a protractor to measure and construct angles" (Conrad, 2004)

The future brought many challenges to the students and teachers guiding the young minds. McCabe (2003) talks about, "institutions are now attempting to help students to define their learning styles as part of learner-centered education" (McCabe, 2003). Teachers' understanding of learning styles was a key part to getting the message across to the young minds needed to understand, retain, and use the much needed information to become successful participants in the world.

"Students who know their best learning style can improve their mathematics learning by using their best style(s) to understand the mathematics concepts" (Nolting, 2003). Teachers understanding the students learning style was essential, the student understanding their own learning style made the teachers and students experience a positive one.

Howard Gardner (1991) identified seven distinct intelligences. His theory through research, "documents the extent to which students possess different kinds of minds and therefore learn, remember, perform, and understand in different ways," (Howard Gardner, 1991)

Through research Gardner (1991) went on to discover differences which challenged the system.

Challenge an educational system that assumes that everyone can learn the same materials in the same way and that a uniform, universal measure suffices to test student learning. Indeed, as currently constituted, our educational system is heavily biased toward linguistic modes of instruction and assessment and, to a somewhat lesser degree, toward logical-quantitative modes as well. (Howard Gardner, 1991)

Lane discussed Gardner's seven different ways that people learn:

1. Visual-Spatial
2. Bodily-kinesthetic
3. Musical
4. Interpersonal
5. Intrapersonal
6. Linquistic
7. Logical-Mathematical

Through Lane's (1998) investigation of Gardner's research Lane (1998) discovered it didn't take one teacher to decide what and how to educate a group of students in a classroom. Decisions such as those take an educated group. Lane (1993) also went on to talk about that the age of multimedia were in and how educators needed to be up to date on the different learning styles.

Applied Mathematics in our School Systems

Mathematic teaching methods in our school systems were frequently reviewed. The students' mathematic performance was poor, consequently many people tried to find out why, but no one really succeeded. The reason was that they were evaluating the students who were failing and dropping out, the so called at-risk youth.

In schools throughout the United States many students were not graduating for the following reasons:

1. Poor self-concept
2. Poor academic performance, high absenteeism, and discipline problems
3. Low aspirations and parents or guardians with low expectations
4. Low family socioeconomic level
5. Nontraditional family life, often with a single or foster parent or with a stepparent
6. Inadequate goals and lack of future orientation

(Terry Vatter, 1992)

The so called at-risk youth that were failing needed something to catch their attention.

That something was a hands on curriculum which had meaning for the students. So many of the students were use to reading and crunching numbers for no apparent reason, when they failed, it meant nothing to them because it was not

real. When teachers and administrators were brought together it was decided to teach these at risk students something the young adults could take home and use. The teachers and administrators finally saw a light at the end of the tunnel. Students that were bored and accepting failure, turned around and showed some interest with a curriculum that meant something.

The three key items teachers saw that helped students succeed were, "1) schoolwork is hands-on 2) students' feelings of worth and accomplishment are nurtured by the work itself, and 3) the work is tied to real work in the real world". (Terry Vater, 1992)

The next process school districts had in front of them was to get other school districts to use this idea. Many states nationwide used a hands-on curriculum, but that does not mean all states knew and used this curriculum as a way of helping students retain mathematics. What some school districts started to do was branch out and get our CTE teachers to use the tactics that teachers already use on a daily basis but stress the mathematics a little more. The school districts were getting the CTE instructors to use math enhanced lesson plans in their shops or classrooms. These lesson plans had hands on projects tied to them so students could relate to the mathematical concept they needed to something the student understood.

Students young or old remembered mathematics when the mathematics was used as an experience. Chemists remembered weights, conversions, and

measurements because the calculations were used on a daily basis. Students that were able to remember in similar ways had an easier time recalling the information when needed.

When students took classes dealing with interesting subjects, the application to mathematics became much easier. Students remembered the basics because students applied the concepts in context. McManus, Dunn, and Denig (2003) discussed hands on curriculum. "Found that biology students who learned using hands-on manipulative activities had higher science achievement and science attitude scores than students who learned using traditional lecture, reading, and discussion activities" (McManus, Dunn, and Denig 2003).

Honeycutt (2007) showed improvement was found in educational research that showed hands on activities and small groups improved academic achievement. The academic achievement was found when hands on teaching was compared to traditional teaching methods in subjects such as science, math, and engineering.

The common rumor amongst many was that applied mathematics was just for your lower/weaker mathematic students. Applied Mathematics goes from basic mathematics (adding and subtracting) to upper level algebra/geometry/pre-calculus.

Applied Mathematics was not built just for lower level students, Applied Mathematics was built to teach all level of students. The students enjoyed

Applied Mathematics and having something to take home because the concepts have been used in everyday life. When students graduated, the mathematics the students would face in the real world was not just an equation with a simple answer at the end. The students dealt with word problems, and multiple ways of answering questions along with multiple ways of dealing with the question. Applied Mathematics put the everyday concept in each problem. Each unit through the hands on mathematics text had questions dealing with business, marketing, engineering, and agriculture. The four different categories of problems showed students that mathematics was used in multiple ways.

Enochs (2008) article discussed how rural schools have been looked down on and have carried the title of being inferior to the urban and suburban schools. Rural education offered avenues that urban schools were not able to offer the students. Through agricultural education offered in rural schools the student was able to take what they knew in the classroom and apply it to a hands on skill.

Formal agricultural education started in America when the Smith-Hughes Act legislation passed in 1917. The act put agricultural education in schools, urban and rural. After the Smith-Hughes Act was passed, the next item that helped out hands on curriculum for students was, "In 1998 the federal government passed the Carl D. Perkins Federal Vocational and Technical Education Act" (Larry G. Enochs, 2008).

Hillison (1996) stated that since the 1800's farmers have been demanding more scientific research. High demand brought on the Hatch Act of 1887 which brought on agricultural experimentations, scientific research, and the cooperative extension service. "Agriculture is an applied science and applied mathematics, why are we just now concerned with incorporating science and math into career and technical education?" (John Hillison, 1996)

"39% of high school seniors are not performing at a basic level in mathematics" (National Council of Teachers of Mathematics, 2000). Educators wanted students to be able to leave the classroom and become productive members of society. As Powell, Agnew, & McJunklin, (2005) quoted, "a successful student will be able to transfer what knowledge they have been taught and transfer that knowledge to a new situation" (Powell, Agnew, & McJunklin 2005).

Contextual learning (Applied Mathematics) was something not only certain schools and teachers felt was a positive step in educating students, but research by the National Council of Teachers of Mathematics (NCTM) also found contextual learning was a positive move in understanding mathematics. "The council's research has shown the importance of contextual knowledge in understanding mathematics" (National Council of Teachers of Mathematics, 2000)

The NCTM saw a contextual environment for students when educating them in mathematics was a move in the right direction. The NCTM's mission and vision statements were as follows.

> The National Council of Teachers of Mathematics is a public voice of mathematics education, supporting teachers to ensure equitable mathematics learning of the highest quality for all students through vision, leadership, professional development, and research.
>
> The National Council of Teachers of Mathematics is a global leader and authority in mathematics education, ensuring that all students have access to the highest quality mathematics teaching and learning. We envision a world where everyone is enthused about mathematics, sees the value and beauty of mathematics, and is empowered by the opportunities mathematics affords.
>
> (National Council of Teaching of Mathematics, 2000)

Summary

Math anxiety was an issue students dealt with on a continuous basis. Anxiety would stem from the student having fears from experiences in their younger years in elementary school to their adult influences. Students needed experiences in their mathematics classes that were positive and show the students that mathematics was something which will be used in everyday life. Math

anxiety was an issue students could deal with if their instructor approached the problem with positive experiences for the students.

Mathematics and the Future was what students needed to look at and realize to go into the world and succeed, mathematics was what they will deal with on an everyday basis. Mathematics in everyday life ranged from the students being able to count money, balance a check book, to figuring the amount of board feet needed to build a shop project. A student graduating high school and going into the college world or work industry needed to understand math. Finding different ways students would not only understand mathematics but retain it for later use was essential for their success.

Applied mathematics in our school system had students enjoying the curriculum that in the past the students wanted nothing to do with. The reason behind students failing in mathematics was students were not interested in something which had no real life application. The students failing in the mathematic arena needed something to bring the equations and numbers together and make sense. Applied Mathematics did just this, the students using hands on labs and problems the students could relate to made mathematics possible. When the students were able to take real world situations and apply numbers to it, the anxiety and stress of not understanding became less of an issue.

CHAPTER 3

Methodology and Treatment of Data

Introduction

Three mathematics classes at River View High School were utilized to research the impact of hands on mathematics. Students that participated in the collection of data were Juniors and Seniors. The student sample ranged in mathematical ability from basic knowledge to Algebra and Geometry. The three classes were chosen at random. No special set ups were taken. Two Applied Mathematics classes that had used hands on mathematics were compared to an Algebra class. Two sets of tests were given to the students. The test was given on September 3rd and November 3rd 2009. The tests were given on the same day to all of the students. The tests were chosen through a collaborative decision of three mathematics teachers at River View High School. The problems that were chosen were problems that the three teachers knew were difficult for most students. The teachers determined the problems would appropriately evaluate Applied Mathematics. The students were tested in September before any instruction had commenced for the year that would have impacted scores. Next, Applied Mathematics students were given curriculum that would assist in reviewing and retaining the information needed to take the test in November. The students that were in the Algebra class were given curriculum that would help them review and retain the necessary information.

Methodology

The research method used to evaluate the differences between the two classes of students was an experimental study. The information was gathered after the tests were administered and categorized by class. The students' names were removed and replaced with numbers. The t tests determined if there was statistical difference between the two classes. The information was then evaluated to determine the effectiveness of the hands on Applied Mathematics in comparison with the group that did not experience hands on instruction.

Participants

All of the Applied Mathematics students that participated in the study had not met the standard for the Mathematical part of the WASL. The students that were in the class were juniors and seniors. The class that was used for comparison where also juniors and seniors. The difference between the students was that the control group had met the standard on the Mathematical part of the WASL. The researcher started off with twenty-five students in each class. Due to attrition and scheduling conflicts some of the students were not able to take the test at the same time as the others. The control group had nineteen students take both tests and the effected group had twenty-three students.

Instruments

In gathering data the classes chosen for the study were two Applied Mathematic classes and an Algebra class. The classes were chosen for reasons

that the teachers felt in comparison of age and race, the classes were matched. The data was gathered by placing a one point value for each question asked and basing each question on the fact of right or wrong with that one point (there was no partial credit). The questions that were chosen were picked by three math teachers at River View High School. The teachers noted the questions that were picked gave a fair representation of the mathematics needed by a student in the young person's high school career. The teachers also noted that these types of problems would show a good representation of Applied Mathematics and if it helped the students retain what was needed or not.

Design

The design used to test the students was a Nonequivalent Control Group Design. In the classes tested due to the school's class schedule requirements it wasn't possible to randomly select students for a control group and an experimental group. The experiment that took place was that students were chosen based on what class the students signed up for, Algebra or Applied Mathematics. Other than that difference the rest of the testing fit the design.

The pre-test was given on September 3, 2009 and the post-test was given on November 3, 2009. The test was given during 4th hour of the Algebra class, the 3rd and 6th hour of the Applied Mathematics classes. The school in which the tests were given at was River View High School. In the Applied Math classes the students were lower level students who did not meet the standard for the

Mathematics portion of the WASL. The Algebra students had all passed the WASL.

After the pre-test was given the Applied Mathematics students received information on the following:

1. Addition of decimals
2. Subtraction of decimals
3. Multiplication of decimals
4. Division of decimals
5. Using decimals in a sentence problem form
6. Changing fractions to decimals
7. Changing decimals to percents
8. Solving word problems with percents, decimals, and fractions

The students in the Applied Mathematics classes were mostly lower income students. The student's racial makeup was White and Hispanic. The students averaged a 2.5 grade point average. Most of the students were unable to do the multiplication tables without a calculator.

The Applied Mathematics class was designed to help students having problems with understanding mathematics. Applied Mathematics gave students something to relate the calculations and equations to. For example, calculating the amount of concrete in cubic yards that would be used in building a foundation for a house. After figuring the cubic feet the students had to find the amount of bags

of concrete it would take to fulfill the needed amount. Another example was the students had to go out and research the amount of drinks consumed through the school year. With the information coming up with graphs representing each month and the fluctuations in the different soda pop consumed.
Through problems like these the students were able to apply mathematical skills from the classroom to situations in real life. The problems come from four different aspects, business, marketing, engineering and agriculture.

The Algebra class included White, Hispanic, and Asian. The students were middle class. The students had no problem doing basic arithmetic. The students in the Applied Mathematics classes received multiple handouts and problems from Unit B in the book dealing with the following:

1. Addition of decimals
2. Subtraction of decimals
3. Multiplication of decimals
4. Division of decimals
5. Using decimals in a sentence problem form
6. Changing fractions to decimals
7. Changing decimals to percents
8. Solving word problems with percents, decimals, and fractions

When the handouts and problems were distributed to the students, 20 minutes of note taking and examples were given to the students to write down.

The students were not only doing the different mathematical actions, but the students were also taught how to explain what was being done when using the actions in word problems. In the material the students received was a mix from handouts, work in the book, and labs in which the students had to apply the mathematics at hand to a real world situation.

Looking at the Nonequivalent Control Group Design the internal and external sources of invalidity are important aspects of how the test was affected. The first internal threat was history. History in this design was a positive point of the design for the reason that students by the books definition are not suppose to be any different from test to test. In the testing environment the students were in the students would have learned a little bit about how the tests are going to be given to them. In other words the students were able to see through tests and quizzes similar questions and the way the questions were going to be on the second test. Seeing quizzes and tests through the two months groomed the students for the post test.

According to Gay (2009) the next source of invalidity to look at would be maturation. Gay (2009) looked at the maturation source and said it was a factor controlled for. The experiment at hand had the pre-test and post-test within two months of each other. The two month period didn't leave a whole bunch of time for the students to go through the physical, intellectual, and emotional changes the book talks about.

The next source of invalidity was testing. The testing was also called pretest sensitization. This source was something which could of very likely occurred for the reason that the pre-test and post-test was given within two months of each other. The two month period could of very well effected the students post-test performance. The one thing that helped out this fact of sensitizing the students performance was that there was a huge difference between the pre-test and post-test scores. The huge difference was the students had to understand the information and not just how the test was given (Gay 2009).

When looking at what Gay (2009) called Instrumentation with the experiment, the experiment looks very good. The reason for this was the tests only varied in its numbers and not how the questions were asked. The instrumentation in this experiment deals with the reliability and consistency of the measuring instrument.

Statistical Regression was something that did not affect the research done on the students. The reason for this was because no student was left out because of his or her test scores. The only action that would prevent a student's score from being entered into the experiment was if the student didn't show up for one of the testing sessions.

In the selection of students for the study, no decisions were made based on the knowledge of what the students had done in the past. The classes of students were picked based on the class the children were in.

According to Gay (2009) the mortality rate in the experiment was higher in the Applied Mathematics classes than it was in the Algebra class. The reason was that the majority of the students that took the pre-test and did not take the post-test did so because they changed classes.

Looking at the selection-maturation interaction when looking at the classes in the experiment that there was plenty of maturing in the two months but in equal amounts. Both the Applied Mathematics classes and the Algebra class had handouts and quizzes dealing with the same type of questions that both tests were given in. So as much as a threat to validity as the information given to the students was, it was done to all students so the percent of consistency was as close to 100 as possible.

As defined by Gay (2009), the pretest-treatment interaction possibility was something interesting to look at. For the reason that even though the students were pre-tested and post-tested with the same type of questions, the work the students did in between the tests had them guessing on what the post-test would be like. The different handouts, bookwork, labs and quizzes the students did had the students explaining how they answered the questions not just writing some answer out. When the students had to explain what they were answering and how they answered it, it made the students slow down and really think about things. When the post-test finally hit them and all they had to do was answer the questions, the students had an easier time doing the post-test then the pre-test.

The possibility of having Multiple-treatment interference could be likely yet it was part of the information the students learned in between the two tests. The information and structure the students received in those two months was different then what the students had dealt with in the past. Tactics such as rewriting the question, explaining how the student answered the question, then writing out the answer was something new. These students had not had to do this in the past. The students were use to coming up with an answer in whatever way they could and hoping the answer was right. So, it was noted that these students dealt with multiple treatment interference but it was part of the treatment all of the Applied Mathematics classes received.

Procedure

To make this study successful and as non-biased as possible specific detail was taken to make sure each of the problems that the students were being tested on would represent how Applied Mathematics would help or hinder the students learning. The three teachers developing the test concluded the basics of most mathematical concepts were covered in the following:

1. Addition of decimals
2. Subtraction of decimals
3. Multiplication of decimals
4. Division of decimals
5. Using decimals in a sentence problem form

6. Changing fractions to a decimals
7. Changing decimals to a percent
8. Solving word problems with percents, decimals, and fractions

The teachers noted that the test does not need to be a lengthy exam, so all students have plenty of time to answer each problem to the best of the student's ability. Along with being able to just see some numbers and do the calculations the teachers noted that the students needed to be able to use these concepts in answering word problems. Four of the twenty problems were word problems and one of the four word problems had three questions that built on one another.

The teachers concluded that setting up the test in this manner would definitely challenge all of the students because high school students were not use to seeing mathematical concepts like this, or having to solve them, especially without a calculator.

Treatment of the Data

The data was handled by using Microsoft Spreadsheet Software, as well as Statpak Data Analysis Software, to find the statistical values. After the tests were taken the tests were graded by one person to make sure no biased were used in evaluating the tests. When all tests were graded the grades were put into a spreadsheet and all names were replaced by a number because names are irrelevant in the study. The other two columns on the spreadsheet were used in putting the two test scores, one for September and one for November. After all of

the grades were entered into the spreadsheet, the two sets of scores in September and November (one for each class) were put into the Statpak. The t-test out of the Statpak was used in finding the differences and similarities between each class. The t-test was also used to find out if significance was found in the hypotheses that were created.

Summary

In summary, an experimental study was conducted to see if any significance was found in testing two classes of students. One class of students being in Algebra, following the traditional curriculum used in that class. The other class of students being placed in Applied Mathematics, a class which takes mathematical concepts and applies the mathematical concepts to real life situations. Having 19 students in the Algebra class and 23 students in the Applied Mathematics classes gave a good sample of the students in the high school, and was also a good average number when looking at class sizes throughout the school. The test scores were tabulated in an excel spreadsheet and then entered into the Statpak. The scores were entered into the independent t-test and the following were taken from the results from the t-test.

CHAPTER 4

Analysis of the Data

Introduction

To research the question, if hands on mathematics works or not was done using three mathematics classes at River View High School. The students that were used in the collection of data were Junior and Senior High students that ranged in knowledge from only basic knowledge to a knowledge of Algebra/Geometry. The three classes were chosen by random and no special set ups were taken. Two of the classes were Applied Mathematics and the class that these two classes were compared to was an Algebra class. There were two sets of tests given to the students. The test was given in September and November 2009. The tests were given on the same day to all of the students. The test chosen to give to the students was a collaboration of three Mathematics teachers at River View High School. The problems that were chosen were problems that the three teachers felt were difficult for all students and that they thought would be best to test Applied Mathematics on. The students were tested in September before any curriculum was gone over that might affect their test scores. The next step taken was that students that were signed up in the Applied Mathematics class were given curriculum that would help them in reviewing and retaining the information needed to take the test in November. The students that were in the Algebra class

were given curriculum that would help them review and retain the needed information at a higher level.

Description of the Environment

Students experienced Applied Mathematics during the fall session of 2009 in a Washington State high school classroom. The students had only been taught using traditional techniques, and did not have any experience with Applied Mathematics. The students experienced the first five chapters of Applied Mathematics including six hands on labs. The students varied in age from 15 to 18. A variety of ethnicities were represented. The instructor did not know the students prior to the first day of school. Students took the pre-test on September third and the post-test on November third. The three classes involved in the study were an Algebra class and two Applied Mathematics classes. The three classes were made up of juniors and seniors, and the students best represented each other when looking at the students competency level.

The students in the experiment classes were split in ethnicities with 50% Hispanic and 50% White. Students in the Applied Mathematics classes were mostly from families in the lower income brackets. Some of the students had been in and out of jail and the home life for some of the students dealt with was not helping the students chances of getting a good education.

When looking at the Algebra class, the students in there came from mostly middle class and even a few upper class families. The home life the students came from was a lot better when compared to the Applied Mathematics classes.

The tests were given during the regular school day class period. None of the students had any idea when the tests were going to be given. The tests only took one class period so there was no outside influence or chance the students could talk about what was asked of them on the test.

The students in the Applied Mathematics class were in this classes for the reason that their WASL scores were not high enough to pass. For this reason the students are put into another Mathematics class that has to be passed or the student doesn't graduate.

Hypothesis/Research Question

Do students who experience instruction through Applied Mathematics experience a positive impact through the students' ability to apply what was learned to a real life situation? Was the hands on way of using what the students had been taught a positive step for the young adults?

Null Hypothesis

There is no significant difference in the performance of students in the Applied Mathematics class and the Algebra class. Significant difference was determined for p greater than or equal to .05, .01, .001.

Results of the Study

The study ended up using 22 students test scores in the Applied Mathematics (treatment group) class and 10 students test scores in the Algebra class (control group). The results showed the treatment group having the biggest change in score. The results showed that Applied Mathematics had a big effect in changing the students ability to answer questions which were difficult for the students to answer during the pretest. The results also showed that Applied Mathematics helped the students learn, retain, and apply the skills needed to answer questions that was difficult for them to answer two months prior.

Table 1
Pretest and Posttest Change in Scores

Treatment Group	Sept.3 Score	Nov.3 Score	Change in Score	Control Group	Sept.3 Score	Nov.3 Score	Change in Score
T1	9	19	10	C1	19	21	2
T2	6	15	9	C2	18	18	0
T3	6.5	14	7.5	C3	16	18	2
T4	7.5	13	5.5	C4	16	21	5
T5	3.5	14	10.5	C5	11	19	8
T6	7.5	14	6.5	C6	16	19	3
T7	7.5	12	4.5	C7	19	22	3
T8	15.5	19	3.5	C8	7	11	4
T9	4	14	10	C9	9	13	4
T10	15.5	19	3.5	C10	19	19	0
T11	8.5	16	7.5				
T12	12.5	16	3.5				
T13	5	14	9				
T14	6	9	3				
T15	4	16	12				
T16	6.5	19	12.5				
T17	3	9	6				
T18	10	13	3				
T19	2	9	7				
T20	7.5	9	1.5				
T21	5	16	11				
T22	6.5	11	4.5				

Results of the study

The information entered into the Statpak produced results that supported the research that was done. The Statpak produced a t-value of 2.42 and degrees of freedom of 28. The values showed that there was a positive influence in how the applied mathematics affected the students in the treatment group.

Table 2
Statpak Analysis

Statistic	Value
No. of scores in Group X	22
Sum of scores in Group X	151
Mean of Group X	6.86
Sum of Squared Scores in Group X	1261.00
SS of Group X	224.59
No. of Scores in Group Y	8
Sum of Scores in Group Y	31
Mean of Group Y	3.88
Sum of Squared Scores in Group X	147
SS of Group X	26.88
t-value	2.42
Degrees of Freedom	28

Results of the Study

The distribution of t supported the hypothesis at .05 and the Null Hypothesis was accepted at .01 and .001. This supported the hypothesis in stating that the author would of been confident 95% of the time Applied Mathematics would be successful in producing results like it did in the study. The other 5% of the time the author would doubt complete success.

Table 3
Distribution of t

df	P		
	.05	.01	.001
28	2.048	2.763	3.674

Findings

The study ended up using 22 students test scores in the Applied Mathematics (treatment group) class and 10 students test scores in the Algebra class (control group). The results showed that Applied Mathematics had a big effect in changing the student's ability to answer questions which were difficult for the students to answer during the pretest.

The information entered into the Statpak produced results that supported the research that was done. The Statpak produced a t-value of 2.42 and degrees of freedom of 28. The values showed that there was a positive influence in how the applied mathematics affected the students in the treatment group.

The distribution of t supported the hypothesis at .05 and the Null Hypothesis was accepted at .01 and .001. This supported the hypothesis in stating that the author would of been confident 95% of the time Applied Mathematics would be successful in producing

results like it did in the study. The other 5% of the time the author would doubt complete success.

Discussion

In Chapter 2 it was discussed that student's young or old remembered mathematics when the mathematics was used as an experience. The philosophy of relating mathematics to real life situations worked in the information discussed about then and proved itself in the experiment also.

The articles discussed when people in the industry were using the mathematics in the work place; the mathematics came easy because it was used daily and continually.

Another article speaking about the process of Applied Mathematics being a helpful tool talked about what happened when students graduated. What the students saw in the real world was extremely similar to what the students saw in the classroom the year before.

The job market was not getting any easier. Not only did we see students from college and high school

competing for jobs, we saw employees from other industries and businesses competing for the same job. Students leaving the scholastic realm wanted to have all the tools and more to compete and overcome the demands asked of them in the job market.

The study confirmed Applied Mathematics taught something which the students retain and can apply to solve the mathematical questions students will encounter in the future.

The information found when the numbers where entered into the Statpak gave a t-value of 2.42 and a degrees of freedom of 28. The two numbers help support the hypothesis that applied mathematics was something very useful in educating students in their mathematical skills.

Summary

Do students who experience instruction through Applied Mathematics experience a positive impact through the students' ability to apply what was learned to a real life situation? Was the hands on way of using what the students had been taught a positive step for the young adults?

The study confirmed the fact of Applied Mathematics being used as a tool that helped students learn, retain, and use mathematics in real life situations. The study involved two classes of a total of 30 students. Parts of the students were in an Algebra class (control group) and the others were in the Applied Mathematics class (treatment group).

The test given to the students was a test which covered the basic concepts derived by three mathematical teachers at River View High School. The first test was given on September 3, 2009 and the second test was given on November 3, 2009. The writer of this paper graded each test. After grading the test each student was listed as a number which was put into a spreadsheet along with their test scores. The test scores were put into an independent t test which produced the t-value and the degrees of freedom needed to find the probability of the study. Using the probabilities .05, .01, and .001, values were produced which showed there was a 95% level in confidence that when the same curriculum was taught it would produce similar results.

When looking at the hypothesis again, the study showed that the Applied Mathematics way of educating the young minds was the way to go. Going through and testing the students, applying mathematics to the real life situations paid off in the long run.

The study consistently showed the treatment given to the Applied Mathematics group of students helped the students increase scores by a greater amount then when compared to the Algebra students. When looking at the difference in the means we see the treatment group having a score of 6.86. The control group had a mean of 3.88. The means were taken from the difference in scores of the first test to the second test. What this tells us was that the average increase in scores for the treatment group was 2.98 points better than the control group.

CHAPTER 5

Summary, Conclusions and Recommendations

Introduction

In order to survive and thrive in school, students needed to fully comprehend mathematical concepts. Many students taught in traditional ways did not succeed in mathematics. As a result, resourceful teachers turned to alternative ways of presenting mathematical theories. The alternative ways which used hands on methods were identified as Applied Mathematics. Through careful instruction using Applied Mathematics, students were able to comprehend theories needed for success in mathematics. The success in using the hands on method provided a basis for success in a teaching career.

According to Gardners (1991) theory, "we are all able to know the world through language, logical-mathematical analysis, spatial representation, musical thinking, the use of the body to solve problems or to make things, an understanding of other individuals, and an understanding of ourselves" (Carla Lane 2008). Gardners (1991) theory argues the fact that teachers needed to be more open and diverse in their presentation of curriculum. Teachers being able to teach to multiple learning styles would have a increasing number of students succeeding at their mathematical skills.

Clearly, mathematics provided a foundation to effectively function in everyday life. Adults exhibited mathematical skills in a variety of daily activities

including: calculating a bank balance, determining the greatest value for purchasing necessities, and counting correct change. The mathematical functions necessary for daily life were important for every job available in the world. Even a farmer who calculated the amount of pesticide necessary for spraying ten ounces an acre exhibited excellence in mathematics. Administrative assistants utilized mathematical concepts as the budget was balanced for an executive meeting. In every job, mathematics provided a framework for a successful teaching career.

At an early age the writer discovered that not all students learned to apply mathematics in similar ways. In the process of assisting classmates throughout high school, the writer found a variety of alternative instruction techniques that students understood. The process of providing critical instruction to peers led the writer to a career in mathematics. The writer of the Special Project has found that through information on the internet and personal experience in the classroom retention of mathematics was much higher when hands on teaching was been applied. "Hands on mathematics has even been proven in biology to help students in college do better on test scores" (McManus, Dunn, Denig, 2003).

Mathematics has been a very important tool that has been used in every facet of our life. We have lived in a high technology world and for us to keep up in the world market, understanding math was a key component. The biggest problem with students not only understanding mathematics was that students were not able to apply the mathematics to something real. "In the real world, if you

cannot understand what it is you are trying to solve, you can't solve it very well" (Harry T. Roman, 2004).

The good number of Washington students experienced failure in mathematics. In 2008, 51.8% of those tested passed the WASL. Clearly students struggled with mathematics. Many students were not able to learn mathematics because it was presented in a way that did not suit all learners. Students needed to see mathematics in an alternative form. Students needed to experience mathematics with their hands.

The purpose of the study was to determine the impact of Applied Mathematics on the instruction of high school students at River View High School. The study was to find out if students that had been struggling with mathematics in past years succeeded and retained mathematical skills through Applied Mathematics.

Summary

Was Applied Mathematics being a hands on real life situation curriculum helping students that have not succeeded in mathematics in the past? The study started on September 3,2009 when the students took the first test and ended on November 3, 2009. The students tested in the study were from two different education levels. Two classes of (Applied Mathematics) struggled with basic mathematics. The other class (Algebra) had succeeded in passing the WASL and

succeeded in passing the other classes in mathematics, so the basic mathematic computations were not a problem for them.

The reason the writer of the project was doing the project was because mathematics was a very important topic at River View High School and across the nation. Students graduating high school and not being able to do basic mathematics was a problem across the United States.

Math anxiety was an issue looked at closely in the research of the project. The writer of the project found through research that math anxiety was something that could stem from parents and teachers speaking badly about the subject or even to the student having personal experiences hindering them from wanting to learn mathematics.

The next topic researched was mathematics and the future. Mathematics was used in everyday life, especially in high end jobs dealing with the influx of technology being used in taking a round world and making it flat and very easy to take local jobs and fill them with international people. Mathematics is used in every worker from your carpenter, plumber and welder to your accountant, secretary, and business person. Students needed to graduate high school with the mathematical knowledge so they could compete in the global job market.

Applied Mathematics in our school systems was the third and final research area. Applied Mathematics was an idea educators had in taking CTE teachers and taking the project based methods they already used and apply mathematics from

the classroom to the projects. Progress showed itself when the curriculum was used in the shop or the classroom. Having the students apply mathematical concepts to everyday problems kept students involved without having to focus on the numbers themselves but the problem the numbers were solving.

After the students were done taking the tests, the scores were put into a independent t test and the degrees of freedom and t value were produced. With these values the writer was able to evaluate if the study supported or not supported the hypothesis. What was found was that there was a 95% chance that the curriculum given to the control group in those two months had significance. As the t value moved toward 99% and 99.9% the study had no significance.

Conclusions

Applied Mathematics helped students learn, retain, and apply mathematical skills needed to be successful in the world. The study supported the research in testing the students and educating one group with applied mathematics. The study supported the hypothesis by showing a significant change in scores by the treatment group when compared to the control group. This enforced the thought that the applied mathematical format of teaching helped students learn, retain, and apply the needed skills to be successful.

Recommendations

As Gardner (1991) discussed the issue that even though the educational system seems to think all students learn the same. Some teachers are trying to

think outside the box and use one of his seven different ways that students can learn.

Mohr (2008) discusses the issue of students complaining about mathematical concepts and teachers hearing on a continual basis, “When am I ever going to use this stuff” (Mohr C. 2008 p.1)?

When people in general are able to learn and use mathematical skills in scenarios they are use to, they remember the concepts. The suggestion when educating students of any age is using Applied Mathematics in teaching those skills needed to help them succeed in the mathematical realm of society.

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Appendix A

River View High School
Applied Mathematics

Dear Parent/Guardian

I am writing you to let you know that your student will be involved in a study for my Master's degree program. This study will take part during the regular hours of the school day using the regular curriculum mandated by the Applied Mathematics standards. This study will in no way hinder your student from learning what they would learn without this study taking place. Your students' information will in no way be given to outside sources.

If you do not want your student taking part in this study please sign below and return to Mr. Holman by Sept. 3rd 2009.

Signature _____