

The Effects of Integrated Math Strategies and Traditional Math Strategies on Academic
Achievement in a High School Algebra Class

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Abstract

The purpose of this study was to examine the effects of integrated math strategies and traditional math strategies on academic achievement in a high school algebra class. The sample consisted of five female and three male high school students who were enrolled in a home school program called Kingsport Area Christian Home Education Association (KACHEA). Data were collected using teacher-made tests. The students were administered a test after being taught using traditional math strategies. Similarly, the students were tested after being taught using integrated math strategies, specifically Khan Academy. The data were analyzed using dependent t-tests. The results indicated a significant difference between the integrated strategies and the traditional strategies ($t(7)=-3.161$, $P<0.05$). There was also a difference between students' performance with fractions when taught by integrated methods and when taught using traditional methods ($t(7)=-4.864$, $P<0.05$). The results suggest that use of integrated math strategies is beneficial in teaching math.

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Chapter 1

Introduction

Mathematics is a fundamental subject and learning its interdisciplinary knowledge like science, technology and engineering, are critical elements for a country to train innovation of new scientific-technological professionals (Ker, 2013). Students in classrooms today seem to be having trouble with the subject. Mathematics education has been observed nationally in hopes of advancing the nation's technical and scientific literacy. The country has witnessed declining mathematics scores on the Scholastic Aptitude Test, along with poor middle school and high school scores on the Third International Mathematics and Science Study. Students need to comprehend and know mathematics so that they can calculate and model what is happening in the world around them (Furner & Berman, 2005).

The research cited above suggests the needs for a change in mathematical instruction in order to achieve the academic success the country is looking for. Some evidence implies that the traditional mathematics curriculum and instructional methods are not assisting students well. Traditional mathematics instruction that comprises of assigning the same problem to every student, teaching from the textbook, and claiming that there is only one way to solve a problem has been suspected as the main reason students are attaining low scores and have a higher math anxiety. The traditional method of instruction is believed to be unsuccessful because it does not reach all students and meet their needs. This type of instruction has prohibited some students from making the most of their skills and capabilities (Oberlin, 1982). On the other hand, teaching mathematics using effective integrated teaching strategies with the use of problem-solving

activities, models, simulations, challenges, and games, has the potential to increase mathematics achievement and decrease mathematical anxiety (Tobias, 1998).

One method that can improve mathematical instruction is using the integration of technology. Technology has been stated by the National Council of Teachers of Mathematics (2000) to be one of the six principles of mathematics concepts. The use of computers in a classroom has been found to increase students understanding of mathematical concepts and increased mathematical problem solving (Manouchehri, 1999). Drill-and-practice activities can be used on computers and are designed to strengthen previously learned information and develop confidence and assurance in a skill. The nature of the computer makes it ideal for offering endless practice in almost any subject area. The computer can deliver hours of practice without getting tired or irritated, and with suitable software, the practice can be individualized and carefully monitored (Hasselbring & Goin, 1988). A specific program that has been used in in classrooms today is Khan Academy.

Khan Academy is known for its collection of 3,500 videos, but its math practice problems and immediate reports are also successfully used in classrooms. Schools use these videos as learning tools to complement and review instruction. Students use them independently to form knowledge in different areas. The adaptive-learning feature of Khan Academy is especially helpful. Every time a student works on a problem, Khan Academy tracks the learning and time spent on the task. The data are used to suggest the next step, either reviewing problems or moving on to the next topic in the subject area. This method of using data to dynamically plan learning assignments assists to guide progress (Khan & Slavitt, 2013).

Math anxiety is a problem that can cause students to have decreased academic success. Integrated mathematics lessons can help with math anxiety by making the student feel more in charge of their learning. When educators use parts of traditional teaching strategies and parts of integrated strategies, such as technology and group work, the evidence of math anxiety declines. In order to have more academic success in mathematics, it is important that educators use different methods of teaching to accommodate each student. (Furner & Berman, 2005).

Statement of Problem

Students learn in different ways, but some educators say that the traditional way of teaching mathematics hinders students from fully understanding mathematical concepts. Research says integrated mathematics lessons result in higher learning and a more positive attitude toward the subject. Therefore, the problem of this study was to investigate the effectiveness of integrated high school math lessons compared to traditional lessons.

Purpose

The purpose of this study was to determine the effects of integrated math strategies and traditional math strategies on academic achievement in a high school algebra class.

Significance of the Study

The topics of different teaching strategies have been researched for years. Educators teach in traditional ways or integrate different methods. In more recent times, educators have been integrating more technology into their mathematics lessons and claiming that it leads to more academic success. It is important to research this topic further because new technologies and programs, like Khan Academy, are still developing and can help in the classroom. More research is needed on this topic so the latest methods of teaching can be included and educators can find the most effective way to teach their students.

Limitations

There were some limitations to this study:

1. The researcher created the test taken by the students and it was not tested for reliability or validity.
2. The sample for this study was not randomly selected and therefore could not make generalizations.

Definition of Terms

1. Traditional Mathematics Lesson- The teacher lectures and assigns problems from the textbook. Each student is assigned the same thing and the entire class learns at the pace the teacher instructs.
2. Integrated Mathematics Lesson- The teacher integrates problem- solving activities, games, and simulations using the free online program, Khan Academy, allowing the students to learn at different paces.
3. Khan Academy- Khan Academy offers practice exercises, instructional videos, and a personalized learning dashboard that allow learners to study at their own pace in and outside of the classroom. They offer math, science, computer programming, history, art history, economics, and more. Their math missions guide learners from kindergarten to calculus using state-of-the-art, adaptive technology that detects strengths and learning gaps. They've also partnered with institutions like NASA, The Museum of Modern Art, The California Academy of Sciences, and MIT to provide specialized content (Khan, Online)
4. Academic Achievement- In this study, the scores on teacher created post tests will determine academic success.
5. Scholastic Aptitude Test (SAT)- are “designed to assess your academic readiness for college. These exams provide a path to opportunities, financial support, and scholarships, in a way that's fair to all students. The SAT and SAT Subject Tests keep pace with what colleges are looking for today, measuring the skills required for success in the 21st century” (SAT, Online).

6. Trends in International Mathematics and Science Study (TIMSS)- “provides reliable and timely data on the mathematics and science achievement of U.S. students compared to that of students in other countries” (National Center for Education Statistics, 2015).

Overview

This study contains five chapters. Chapter one includes the introduction, problem statement, purpose statement, significance, limitations, definitions, and overview of study. Chapter two contains the review of literature. Chapter three contains methodology and procedures, population, sample, data collections instruments, procedures, and research questions and related hypotheses. Chapter four covers data analysis, collection of data, and research questions and related hypotheses. The final chapter, chapter five, includes summary of findings, conclusions, recommendations, and implications of this study.

Chapter 2

Literature Review

Striving to improve mathematics education has always been a large issue. Governments of many countries and the school systems within them are struggling with how to deliver the best mathematics education for students. In a study conducted by H. W. Ker, China, Singapore and the United States were compared on their student's mathematical achievement. The research studied students in the fourth to eighth grades and used Trends in International Mathematics and Science Study (TIMSS) 2011 data to conduct an investigation on mathematics performance at different International Benchmark levels. The results indicated that Singapore had the most effective math education among the three countries. America's scores were very different. The TIMSS results show that there was a significant gap in average mathematics achievement between the two Asian countries and the United States. Mathematical proficiency is important in learning many other subjects, like subjects associated with engineering or science. It is significant that students learn math, especially early in their education (Ker, 2013).

Mathematics Anxiety and Achievement

Students often have a difficult time achieving mathematics success because of their poor attitudes about the subject. A lot of students suffer from math anxiety. Knowing the causes of mathematics anxiety can help in understanding how educators can better equip themselves in aiding students to learn math. Richardson and Suinn (2013), as cited by Maloney, Schaeffer, and Beilock, define mathematics anxiety as "the negative reaction that many people experience when placed in situations that require mathematical problem solving" (p.116). Symptoms of math

anxiety may comprise of a rise in heart rate, confusion, nausea, stomach discomfort or disorders, sweating, headaches, and even panic. These feelings of distress impede the performance of the student (Chernoff & Stone, 2014). Dr. Eugene Geist (2015) found a close relationship between math anxiety and math ability in 1st through 3rd graders and proposed that this is the time when math anxiety first begins to occur. The young age that math anxiety is taking place can hinder a student's mathematics learning throughout their entire schooling career. Geist's research found that math anxiety and negative attitudes toward mathematics in teachers are related and also have an effect on the students they teach. This study indicated that the teacher's feelings of anxiety about math affect their curricular planning choices as well as their ability to teach mathematics. The more mathematics a teacher knows, the more confident they are and the better they could teach. A study conducted by Harper and Daane (1998) analyzed the math anxiety levels of 53 elementary pre-service teachers before and after a mathematics methods course. At the end of the mathematics methods course, the level of math anxiety of the pre-service elementary teachers lowered drastically from the level of math anxiety at the beginning of the course. The research recommended that pre-service teachers be made conscious of their individual levels of math anxiety and learn ways of avoiding their own negative outlooks toward mathematics from being transferred to their future elementary students.

Many other causes of math anxiety and poor attitudes toward math have come from stiff and regulated classroom instructional practices. Students have often felt under pressure to do math in a certain amount of time. Some students have even experienced upsetting situations where they were made to feel stupid or dumb in front of the class. There are a lot of different causes of math anxiety and finding a way to help those decrease is a goal of educators around the

world. Dealing with student's math anxiety and unfortunate attitudes toward mathematics is a hard part of teaching. (Harper & Daane, 1998)

Furner and Berman (2003), as cited by Chernoff and Stone (2014), compiled a list from the National Council of Teachers of Mathematics Standards that says the following can help with math anxiety; teaching students how to think for themselves; working in groups; resourcefully using technology; including more statistics and probability; and focusing on more realistic problem-solving experiences. Another way of decreasing math anxiety is the incorporation of different teaching strategies and assessments. (Chernoff & Stone, 2014).

Different Types of Learning

Realizing that there is a problem with student's math anxiety and attitudes towards mathematics, researchers have been investigating ways to decrease this issue. Dotger and Causton-Theoharis (2010) suggest that differentiation will aid in helping students overcome academic struggles. They define differentiation as recognizing that students' readiness levels, securities, and motivations differ, even inside the same grade level. These differences influence how students learn and the pace they need instruction. Differentiation helps learning become more equal for all students. It creates a classroom environment in which all students cultivate a feeling of belonging and approval. When teachers exclusively control learning, students may not produce creative questions. As educators' see their classes' variety, they recognize the need of fluctuating their instructional strategies. Studies show that using differing teaching strategies to reach every student, the teacher becomes the implementer of students' learning and the students became more self-governing learners (Beecher & Sweeney, 2008).

Carr and Bertrando (2012) recommend that teachers use teaching strategies such as visuals, thinking aloud, pairing, advanced organizers, graphic organizers, and summarization to assist in differentiation. These strategies lend themselves well to all learning types; students who learn from visualizing would benefit from the visuals and graphic organizers, auditory learners will appreciate the thinking aloud and summarization activities, and kinesthetic learners will enjoy graphic organizers, as well, to have a physical object to hold while learning. Haas' (2003) research, as cited by Rapp (2009), finds that auditory learners tend to do well in subjects where the course, materials, and instructional methods are mostly chronological and offered in auditory format, like mathematics. Silverman (2002), also cited by Rapp, states that auditory learners would voluntarily recall their math facts, memorize the steps to multiplication equations, answer the homework problems correctly, and earn A's in the class without sincerely understanding the basic mathematical theories. This instructional strategy can deliver advantages in learning mathematical concepts, but too much reliance on auditory math teaching methods may cause struggles for visual learners. Visual learners would not only miss the basic mathematical theories but they may not be able to recall math facts, or be able to memorize the steps to multiplication equations. Hence, visual learners are less likely to get accurate answers to the homework problems, leaving them with low self-value and an apparent insufficiency in mathematical capability. The main point of using different instructional strategies is to make sure every student has the chance to learn. Using several strategies during a lesson will help achieve that (Rapp, 2009).

Studies on integration of subject areas has also been shown to have powerful effects on learning, arts-incorporated curriculum can offer students with a relevant education that exceeds disciplinary boundaries and involves learners through self-reflection and active analysis.

Research shows that interdisciplinary education not only increases students' higher-order thinking skills and motivation, but also delivers opportunities to understand knowledge from numerous perspectives and aid in learning (An, Capraro, & Tillman, 2013). Research by Allcock and Hulme (2010) suggest that as long as teachers plan quality, diverse lessons with ways for all students to approach the information, students can achieve without one method being greater than another. This shows that differentiation helps the teacher choose what activities to include in the lesson as well as support the students in learning. As stated before, Chernoff and Stone suggest using different teaching strategies as a means of decreasing math anxiety. With a decrease in math anxiety, students have more opportunity for mathematical achievement.

Use of Technology in Education

Researchers have found several methods to incorporate different learning styles that benefit the class as a whole. One of the ways a teacher can fall away from traditional instruction and integrate other strategies is with the use of technology. Rutherford et al. (2010) conducted a study that analyzed a program designed to improve student math achievement through a significant randomized field trial of Spatial-Temporal Math (ST Math), a great collection of interactive mathematics software. ST Math offers individualized supply of a mathematics curriculum based on standards by exploiting on the fact that many essential math concepts like fractions, proportional reasoning, symmetry, and arithmetic operations, can be obtainable as graphic images. ST Math software games allow students to solve problems by answering problems presented inside an image-based medium. Traditional math instruction, which usually trusts greatly on verbal statements, is not producing the achievements necessary for students to

succeed in mathematics. In the study, ST Math provided a distinct approach that met the needs of larger numbers of students by accessing their spatial ability and using that to construct natural understandings of foundational math concepts such as functions and proportionality. Moreover, ST Math helps students who have been left behind by the standard educational system. Initial findings of this research show promising results for ST Math in this randomized field trial. Collective student scores inside each grade in each school show that ST Math positively affects mathematics (Rutherford et al., 2010).

Another technological program that has helped students in many areas, particularly math, is Khan Academy. The Khan Academy site currently has more than 3,200 instructional videos online. Schools use these videos as learning tools to complement and review material. The site offers an adaptive-learning feature where a student works on a problem, then Khan Academy tracks the learning and time on task. Khan Academy uses these data to suggest the next step, either reviewing problems or moving ahead to the next topic (Schroeder, 2012). This gives the student more independence of his or her own learning. If a student needs to pause the video and rewind to hear something again, they can do so and they wouldn't be holding up the class. The students who are working faster than most can go to different sections or work on more problems. This allows students to learn at their own pace. Light and Pierson (2014) observed classrooms that used Khan Academy; teachers generally used a mixture of whole class instruction and individual work as the whole class traveled through the same set of problems. In all, students might go through 10 problems during the class and they were engaged in doing so as teachers floated around the room. Khan Academy permitted students to move at a pace that is more fitting to their learning needs. The teachers reported that students were doing more math problems than they would in a traditional classroom setting.

The use of technology in the classroom is a great way to integrate different types of learning strategies. Technology can offer traditional strategies, such as working math problems repeatedly, but the online setting makes it more modern. It can also provide auditory and visual learning. Research conducted by Jacob D. Gardner (2011) found that the majority of teachers interviewed in the study agreed that technology is a tool that should be used no matter what you have in the classroom. Technology is meant to enhance the learning experience of students and the teachers agreed that this was important because of the culture of technology that students grew up in. Overall, it is clear that most teachers in this study viewed technology as a tool. Technology should never over take the role of the teacher in the classroom but it should just amplify it.

Traditional Strategies compared to Integrated Teaching Strategies

Traditional strategies of teaching mathematics are not an incorrect method of instruction. In fact, the traditional way of teaching math is helpful for some students and can lead to high academic success. But research shows that students learn at different speeds and in different ways (Rapp, 2009). With integrating different teaching strategies inside each math lesson, mathematics educators can reach a larger amount of students. The two main types of learners seen in research by Rapp (2009) are auditory learners and visual learners. Incorporating varied instructional methods such as graphics, technology, cooperative learning activities, videos, computer games, and many others; can help teachers in planning lessons that will better meet the individual students where they are. With integrated strategies, students have a feeling of ownership and control of their learning which creates a motivation that might not surface if that feeling of independence was not present (Light & Pierson, 2014).

Research by Rapp (2009) suggests that teaching traditionally and heavily relying on auditory lessons can be morphed into more modern integrated lessons by incorporating visualization strategies, letting the student create a picture or movie in his or her head. An efficient way to do this is to begin with the equation and turn it into a story problem. Permit the visual learner time to interpret the information into visual images and help fill in the details. Educators should always present the students with the end goal and avoid going through the steps you would use, and give the student room to work through the problem their way.

Teachers need to learn their class' strengths and weaknesses, and better recognize the different ways each student learns. This is a big task for educators, as it takes a while to really get to know students. The lessons of the class can be tailored to fit that particular class and should be varied in teaching methods to accommodate different learning styles and increase motivation (Dotger & Causton-Theoharis, 2010).

Conclusion

Mathematics is a challenging subject for both students and teachers. Research has found that the United States scores on their student's mathematical achievement were significantly lower than those of other countries, like China and Singapore (Ker, 2013). A reason for low achievement in mathematics is caused by the anxiety some students experience when asked a mathematical problem. Studies have also shown that the lack of prepared, competent teachers can result in educators experiencing math anxiety, ending in the transfer of that anxiety to the students (Geist, 2015). Sometimes the teacher's themselves do not experience math anxiety, but the way they present the lessons can cause students to feel pressured or confused. More

traditional teaching strategies can lead to students feeling like they have to finish their work in a certain amount of time, which can result in math anxiety (Harper & Daane, 1998).

Another perplexing fact of mathematics instruction is the fact that every student differs in the way they learn. This is true in every subject area, not exclusively math. Rapp gives sufficient research data that helps educators see the different ways auditory and visual learners process information. The use of some teaching strategies such as visuals, thinking aloud, graphic organizers, pairing, summarization, and advanced organizers help to assist in differentiation (Carr & Bertrando, 2012). A major teaching strategy that reaches several learning types is the integration of technology.

Technology has become a chief learning tool in schools all over the country. Different programs used with technology have been researched and found effective in classroom settings. ST math, researched by Rutherford, was found positive results in increasing mathematics scores and also help in filling in the gaps between math ability. (Rutherford et al., 2010). A different program that is available through the internet and is completely free, is a sit called Khan Academy. Light and Pierson (2014) did research on this learning tool and found that the students were doing more math problems than they would in a traditional classroom setting. They also found that the individualized instruction of Khan Academy caused the students to gain an ownership of their learning (p.115). Technology can be used in many different ways; it doesn't have to be limited to programs. Other uses of technology, such as Smart Boards and PowerPoints, can be used in the classroom to add some differentiation by providing visuals and interactive material to a lesson.

Finally, the research on traditional teaching strategies and integrated teaching strategies in the subject of mathematics has shown that both have an impact on the way students absorb the information. Most research found that integrated teaching strategies lends itself better to a bigger learning audience, while traditional teaching strategies may work well for some but prohibit others from learning to their full potential (Oberlin, 1982). This study is going to look at the usefulness of integrated high school math lessons compared to traditional lessons.

Chapter 3

Population

The population for this study came from Kingsport Area Christian Home Education Association (KACHEA). The association has 363 students enrolled in 2015. The students range from preschool to 12th grade. KACHEA follows the teachings of the Christian faith and claims Christianity as their official religion. There are 192 boys and 171 girls enrolled in KACHEA.

Sample

The sample for this study consisted of 7 high school students enrolled in KACHEA. Four students were female and the remaining three were male. The Sample was not randomly selected. This was a convenience sample. The ages of the students ranged from 15 to 18 years old.

Data Collection Instruments

Data were collected by using two teacher made tests. The topic of Statistics and Probability was chosen to be the topic of instruction. The unit was divided into two equal halves of same difficulty and comprehension. The unit was taught with traditional methods and integrated methods using Khan Academy as a teaching tool.

The first half of the unit was a traditional lesson and was taught using a white board and a worksheet that the students worked on independently. The topic was discussed and shown on the board and then the students helped answer a few practice problems on the board before they independently worked on their worksheets. At the end of that half, a test was administered and scored were registered.

The second half of the unit was an integrated lesson and was taught using a video on Khan Academy website where the students individually watched the video and could watch it as fast or slow as needed. Then they were asked to complete some practice problems provided by Khan Academy until they got three correct in a row. After the end of the second half of the unit a test was administered. The results of the first half of the unit were compared to the second half.

Procedures

Before the study began, permission was sought from the head of KACHEA. After permission was granted, consent letters were sent to parents seeking permission to use their children for this study. A sample was selected from those who were allowed to participate.

The sample consisted of 7 high school students enrolled in KACHEA. Four students were female and the remaining three were male. The ages of the students ranged from 15 to 18 years old. The topic of Statistics and Probability was chosen to be the topic of instruction. The topic was taught with traditional methods and integrated methods using Khan Academy as a teaching tool.

The traditional lesson was taught using a white board and a worksheet that the students worked on independently. The topic was discussed and shown on the board and then the students helped answer a few practice problems on the board before they independently worked on their worksheets.

The integrated lesson was taught using a video on Khan Academy website where the students individually watched the video and could watch it as fast or slow as needed. Then they were asked to complete some practice problems provided by Khan Academy until they got three correct in a row.

After each lesson was complete, similar tests were given. The assessments were compared and analyzed.

Research Questions and Related Hypotheses

Research Question 1: Is there a difference between students' performance when they are taught with traditional teaching methods and when they are taught using integrated teaching methods like the use of Khan Academy?

Research Hypothesis 1: There is a difference between students' performance when they are taught with traditional teaching methods and when they are taught using integrated teaching methods like the use of Khan Academy.

Null Hypothesis 1: There is no difference between students' performance when they are taught with traditional teaching methods and when they are taught using integrated teaching methods like the use of Khan Academy.

Research Question 2: Is there a difference in student's performance with fractions when taught by integrated methods?

Research Hypothesis 2: There is a difference in student's performance with fractions when taught by integrated methods.

Null Hypothesis 2: There is no difference in student's performance with fractions when taught by integrated methods?

Chapter 4

Data Analysis

The purpose of this study was to determine the effects of integrated math strategies and traditional math strategies on academic achievement in a high school algebra class. The study examined the effects of integrated math strategies by using an online tool called Khan Academy as the integration for the lesson.

Collection of Data

Data were collected by using two teacher made tests. The topic of Statistics and Probability was chosen to be the topic of instruction. The unit was divided into two equal halves of same difficulty and comprehension. The unit was taught with traditional methods and integrated methods using Khan Academy as a teaching tool. The first half of the unit was taught using traditional strategies and included a white board and a worksheet that the students worked on independently. At the end of that half unit a test was administered and scores were registered. The second half of the unit was taught using integrated strategies and incorporated a video on Khan Academy. After the end of the second half of the unit a test was administered. The results of the first half of the unit was compared to the second half. The demographic profile of the students is displayed in Table 1.

Table 1

Demographic Profile of Students

Group	Gender	Frequency(f)	Percent(%)
KACHEA Class			
Male	3	3	37.50
Female	5	5	62.50
Total	8	8	100.00

Research Questions and Related Hypothesis

Two research questions and two research hypotheses guided the analysis of data.

Research Question 1: Is there a difference between students’ performance when they are taught with traditional teaching methods and when they are taught using integrated teaching methods like the use of Khan Academy?

Research Hypothesis 1: There is a difference between students’ performance when they are taught with traditional teaching methods and when they are taught using integrated teaching methods like the use of Khan Academy.

A paired samples T-test (Dependent T-test) was calculated comparing the mean scores of traditional and integrated methods. There was a significant difference between the means of the two groups ($t(7)=-3.161$, $P<0.05$). The mean for the integrated method was significantly higher ($M=91.63$, $sd=23.688$) than the traditional method ($M=62.50$, $sd=6.682$). Therefore, the null hypothesis was rejected. The effect size was 1.12.

Effect Size: $\text{mean difference/standard deviation} = ((91.63-62.50)/26.057) = 1.12$. The results are displayed in Table 2.

Table 2

Paired Samples t-test for Traditional and Integrated Methods Scores

Method	M	df	N	t-value	2-tailed Sig.	ES
Pair 1						
Traditional	62.50	7	8	-3.161	.016	1.12
Integrated	91.63		8			

Note: $p<.05$

Research Question 2: Is there a difference in student's performance with fractions when taught by integrated methods and when taught using traditional methods?

Research Hypothesis 2: There is a difference in student's performance with fractions when taught by integrated methods and when taught using traditional methods.

To answer research question 2, a paired samples T-test (Dependent T-test) was calculated comparing the mean scores of fraction questions in traditional methods and integrated methods for students. There was a significant difference between the means of the two groups ($t(7) = -4.864$, $p < 0.05$). The mean for the integrated method fraction questions were significantly higher ($M = 91.63$, $sd = 23.688$) than the traditional ($M = 31.25$, $sd = 17.678$). Therefore, the null hypothesis was rejected. The effect size was 1.72.

Effect Size: mean difference/standard deviation = $((91.63 - 31.25) / 35.108) = 1.72$. The results are displayed in Table 3.

Table 3

Paired Samples t-test for Traditional and Integrated Methods Fraction Scores

Method	Mean	Std. Deviation	t	df	Sig. (2-tailed)	ES
Traditional	31.25	35.10	-4.864	7	.002	1.72
Integrated	91.63					

Note: $p < .05$

Chapter 5

Summary of Findings, Recommendations, and Implications

This chapter includes a summary of findings, recommendations, and implications of the research conducted to determine the effects of using integrated math strategies to teach high school algebra students compared to using traditional math strategies.

Summary of Findings

In regard to Research Question #1, is there a difference between students' performance when they are taught with traditional teaching methods and when they are taught using integrated teaching methods like the use of Khan Academy? A dependent t-test revealed a significant difference between integrated and traditional methods ($t(7)=-3.161$, $P<0.05$). Therefore the null hypothesis was rejected.

All the students in the class were taught using traditional strategies first and later taught using integrated strategies. The students were not told what strategy was being used in the lesson. The unit taught was Probability and Statistics. The students had a tendency to lose focus during the traditional method. They were unable to remember what was being taught and were uninterested. When using the integrated method, students seemed more focused. The students seemed more interested in the integrated method and were consistently showing understanding by correctly answering practice problems on the Khan Academy website.

In regard to Research Question #2, is there a difference in student's performance with fractions when taught by integrated methods and when taught using traditional methods? Again

the results indicated a significant difference between using integrated and traditional math strategies when teaching fractions ($t(7)=-4.864$, $p<0.05$). Therefore the null hypothesis was rejected.

The students also had a tendency to be unmotivated to learn and practice fractions with the traditional method. Silverman (2002), cited by Rapp, states that the traditional instructional strategy can deliver advantages in learning mathematical concepts, but too much dependence on auditory math teaching methods may cause battles for visual learners. The students continued to show interest in the lesson, even with fractions, when teaching with the integrated method. Research guided by Jacob D. Gardner (2011) found that the majority of teachers questioned in the study agreed that technology is an instrument that should be used no matter what you have in the classroom. Technology is meant to improve the learning experience of students and the teachers agreed that this was important because of the culture of technology that students grew up in. This research is consistent with the findings of this study. The students showed a consistent interest when using Khan Academy.

Students were exposed to Khan Academy and allowed to watch the video as fast or as slow as they needed. They had the chance to pause and replay the video. They also had the option to do practice problems provided by the website. The website is set up to mirror a game atmosphere. The more questions you get correct, the further you can move up in points. This made the students more engaged and caused them to listen and focus more carefully.

Students reported that they liked watching the Khan Academy video and thought that it was more beneficial than the first lesson, the traditional method. They all seemed more engrossed in the lesson when using Khan Academy. When teaching the traditional lesson, I could tell that the students were easily distracted and did not listen as well. This might have resulted

from the time of day and transition that had just taken place. In the end, students were able to correctly answer questions on probability and statistics after being exposed to the integrated lesson.

The findings from the conducted research are consistent with the findings of Schroeder (2012), Light and Pierson (2014), and Jacob D. Gardner (2011) and confirms that technology, specifically Khan Academy, is a successful tool to use in an integrated math lesson. Students who are not focused and motivated will not learn what is required of them. Using integrated math strategies such as Khan Academy can elevate student's motivation and keep them focused as well as help students have a sense of ownership of their learning (Light and Pierson, 2014). Students like having the ability to take part in the direction of their learning, and giving them more independence in that integrated method allows this. The findings of this study indicate that there is an improvement in test scores when students are taught using integrated math strategies and given more independence to learn at their own pace.

Conclusions

The purpose of this study was to determine the effects of integrated math strategies and traditional math strategies on academic achievement in a high school algebra class. Two dependent t-tests were conducted and both tests indicated a significant difference between integrated and traditional math strategies. The first test between integrated and traditional strategies displayed a difference in test scores, showing that students did better overall when using integrated methods rather than traditional. The second t-test also showed a difference between fractions and the two methods, it exhibited that the students did better with fractions

when being taught using integrated methods. Therefore, the inference can be made that using integrated math strategies when teaching high school algebra students does positively affect their performance on tests.

Recommendations

1. This study should be repeated with a larger sample population. Having a larger sample population will validate the results of this study.
2. Further research should use other types of subject matter to determine whether the results would be different.
3. Based on the encouraging findings of this study, the research should be expanded to use other integrated strategies in teaching probability and statistics.

Implications

Math anxiety and low math test scores are common across the United States. Research shows that using integrated math strategies help student's motivation and test scores. The following implications of this research are as follows.

1. Teachers should continue to use integrated math strategies in their lessons and use technology as an integrated strategy, which is a great way to get students motivated.
2. Parents should encourage their children to continue their learning at home by accessing online learning tools like Khan Academy on the weekends or in the summer to instill a love of learning in their children.

3. School administrators should support technology in the classroom and provide recourses for teachers to easily access technology when needed for a lesson.
4. Students can be inspired by the fun atmosphere integrated math strategies bring. Seeing the laid back nature of learning with Khan Academy, students can be encouraged by their achievement on the site by earning points and moving up in levels.

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