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Using Teacher Instructional Time More Efficiently Through the Use of MadMinute Software: A Tool for Teaching Elementary Children Basic Mathematics Facts

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Abstract

Time constraints often force elementary mathematics teachers to teach only from the textbook and sacrifice conceptual, hands-on approaches to mathematics instruction. This study explores the potential time-saving benefits of using MadMinute computer software to teach elementary students basic mathematics facts. Data was collected by administering pretests and posttests to participating students, and through time logs kept by participating teachers. Results showed that teachers who used MadMinute software saved a mean of 20.4 minutes of instructional time per day, compared to teachers who used traditional methods of mathematics facts instruction. Students receiving traditional methods of instruction had higher levels of growth, although not enough to be of statistical significance.

Using Teacher Instructional Time More Efficiently Through the Use of MadMinute Software: A Tool for Teaching Elementary Children Basic Mathematics Facts

Teaching elementary students basic addition, subtraction, and multiplication mathematics facts is a necessary, but time consuming element of any mathematics curriculum. Teachers have an overabundance of curricular material that needs to be covered and are always looking for ways to use class time more efficiently. This study examines 27 kindergarten through sixth grade students in a small, rural, Midwestern Christian school to determine if computer software can be used to teach math facts in such a way that less teacher instructional time is needed. By reducing the amount of teacher instructional time spent on low-order thinking skills, such as the memorization of mathematics facts, teachers will have more instructional time available to teach other mathematics concepts using creative, hands-on methods. The focus of this study was not on the amount of time students devoted to practicing basic mathematics facts. Instead, the focus was on reducing the amount of instructional time teachers needed to teach basic mathematics facts. MadMinute software is intended to be used by students during their down time – time when students are looking for something to do or waiting for the next class (or recess) to begin. Results of this study suggest that MadMinute software significantly reduced the amount of class time needed to teach mathematics facts to a level of automaticity, when compared to traditional methods of mathematics facts instruction.

Problem Statement

The purpose of this study was to determine if MadMinute software can be used to teach mathematics facts in less instructional time than traditional methods of instruction, while achieving the same level of competency. The author examined one primary question during the study: Does a statistically significant difference exist between the control and experimental groups in terms of competency, as measured by pretest to posttest gains, despite reduced instructional time dedicated to the experimental group?

Null Hypothesis

Given that there will be less instructional time dedicated to the experimental group, nevertheless, the null hypothesis states that there will be no significant difference between the control group and experimental group regarding growth in memorizing mathematics facts.

Definition of Terms

An instructional method that takes less time but produces less learning is undesirable; therefore, measuring competency is important to the validity of this study. Competency is measured by determining the difference in improvement between pre and post study tests that are given to each student.

For the purpose of this study, mathematics facts are limited to addition and multiplication problems, using addends or factors from one through nine. Students in kindergarten through third grade received addition problems, while students in third through sixth grade received multiplication problems.

Methods of traditional mathematics facts instruction are defined as flash cards, paper-pencil quizzes, and textbook practice questions – commonly used forms of mathematics facts instruction seen within typical elementary classrooms.

MadMinute is a computer program specifically designed by myself and a colleague. It presents timed mathematics facts drills, also referred to as quizzes, to individual students (times can be adjusted for each student). The teacher is able to limit questions on quizzes to specific numerals. After a quiz, MadMinute software corrects the quiz, shows students their errors, and displays a graph of their individual progress. The program automatically adjusts future quizzes to provide more questions in each student's weakest area. In this study, students using MadMinute software were required to take a daily quiz using the software, each quiz being 90 seconds in duration.

Limitations

This study was conducted in a very small, rural, Midwestern, Christian school. This presented several obvious challenges to my study. First, the sample size was limited to a total of 27 students in kindergarten through sixth grade. Second, the school only consists of two classrooms and two fulltime teachers – a kindergarten through second grade teacher and a third through sixth grade teacher. Other limitations included the prior attitude of teachers towards mathematics instruction and computer instruction. This study was limited to 10 days in an effort to prevent educational harm from being done to either the control group or the experimental group. Lastly, because I worked closely on improving and developing this program with its creator, Dr. Roy Doorenbos, a potential limitation could be a personal bias in favor of MadMinute software.

Review of Literature

Most teachers and administrators would agree that computer technology is a necessary and important component of grade school education in today's schools. Still, the use of computers in elementary classrooms remains an area of confusion and concern for many teachers. According to Education Week's (1999) national survey of 1,407 teachers across the United States, only 53% of teachers use computer software in their classrooms (Fatemi, 1999). In terms of mathematics, it is important that we understand the importance technology plays. The National Council of Teachers of Mathematics states, "Technology is essential in teaching and learning mathematics; it influences the mathematics that is taught and enhances students' learning" (National Council of Teachers of Mathematics, 2000, p. 24).

Undergraduate elementary education programs are emphasizing the need for conceptual understanding in mathematics. Drill and test methods are being replaced with hands-on, inquiry based methods of mathematics instruction (Waite-Stupiansky & Stupiansky, 1998). The learning of basic mathematics facts requires rote memorization as well as drill and practice activities. Despite the reduction in rote instruction, the learning of basic mathematics facts remains important. Research indicates that students who learn these facts to the point of automaticity are better prepared for more complex mathematical concepts, such as two-digit addition (Cooke & Reichard, 1996). However, to achieve automaticity, teachers must regularly devote class time to allow students to practice mathematics facts, something that often gets overlooked in a busy classroom (Cooke & Reichard). Reaching a level of automaticity appears to be even more important for students with disabilities. Without attaining fluency of mathematics facts, students with disabilities are often overwhelmed by the challenges of advanced mathematical concepts (Cooke & Reichard).

Throughout the 1980s and 1990s, researchers explored the potential for improved student learning through the use of computer-based technology. After analyzing the data from over 500 studies on computer based instruction, James Kulik (1994) discovered that not only do students learn more when using computers, they learn in less time. Likewise, Jay Sivin-Kachala reports, "Technology has demonstrated a significant positive effect on achievement. Positive effects have been found in all major subject areas, in preschool through higher education" (Sivin-Kachala & Bialo, 2000). The state of West Virginia commissioned a study to analyze achievement levels among its students after implementing a computer education program. The study showed that among 950 fifth grade students, those who received consistent, regular access to the computer education program implemented by the state achieved the most significant gains on the Stanford 9 standardized test (Schacter, 1999). When looking specifically at drill and practice activities, Kulik found that students using computer software for such tasks achieved greater statistically significant growth than students being taught with traditional methods of drill and practice (as cited in Sivin-Kachala & Bialo). However, it was noted that drill and practice software must be carefully selected in order to produce positive results. Some research has shown that certain types of drill and practice software produced less positive achievement results than did open-ended software that required students to be more creative in their thinking (Sivin-Kachala & Bialo). Other studies seem to suggest that drill and practice software has a greater benefit on low-performing students and students with disabilities such as attention disorders (Sivin-Kachala & Bialo; Fitzgerald, Fick, & Milich, 1986).

An interesting study on the effects of drill and practice computer instruction on learning basic mathematics facts (Harrison & Van Devender, 1992) compared achievement scores of elementary students who used traditional methods of mathematics facts instruction with those who used drill and practice computer software. Harrison and Van Devender defined traditional methods of mathematics facts instruction as those using flashcards, worksheets, and recitation. Over the course of an eight week period, 93 students received either traditional instructional methods or computer assisted instruction twice a week for 30 minutes per session. At the conclusion of the 8 week study period a posttest was administered. The data collected during this study demonstrated that "at a 95% confidence level, the group receiving computer instruction showed significant favorable differences in subtraction and multiplication test score improvements" (Harrison & Van Devender). Students receiving computer instruction also showed greater improvement in both addition and division, although not at a statistically significant level.

Further studies support the findings of Harrision and Van Devender. In a 1998 study, researcher Jamillah Grant asked the question, "Does Integrating Technology into the Curriculum Increase Student Learning?" Grant focused on 47 fifth grade students and analyzed whether a computer based instructional approach would increase learning. Grant also administered a survey to determine the effects of computer instruction on the attitudes of students towards the subjects English and mathematics, and school in general. Findings showed that students receiving computer assisted instruction in mathematics and

English did not show statistically significant change in attitude toward those two specific subject areas. However, students receiving computer assisted instruction did show a statistically significant change in attitude toward school in general. Grant reports, "The treatment group showed a positive significant change in the category of general attitudes toward school" (Grant, 1998). Grant concludes that integrating computer technology into the curriculum coincides with Massachusetts State Standards; implications of the study suggest that computer assisted instruction increases student learning and improves student attitudes toward school (Grant, p. 11).

In a study very similar to my own, Lynda Williams compared two methods of teaching multiplication facts to students – traditional methods and computer assisted instruction (2000). Williams examined 26 seventh grade students, whose pretest and posttest scores were analyzed to determine if significant differences occurred between students receiving traditional methods of multiplication facts instruction and those using computers to learn the multiplication facts. Her results showed that at the .05 level of significance, the group of students using computer assisted instruction showed more improvement than did those using traditional methods of instruction. Williams speculates that one of the reasons the group receiving computer assisted instruction performed better was because they "enjoyed working on the multiplication facts and did not complain" (2000, p. 19). Williams observed that students in the group using traditional methods became "disinterested in trying to improve" (2000, p. 20). This study adds to a growing number of research that arrive at similar conclusions – computer assisted instruction improves student learning and positively changes student attitudes.

Teachers often feel pressured by time. They have a lot of material to cover, they want to teach it creatively, but there is only so much time in a day. These pressures lead them to make sacrifices – every day they must prioritize their time and decide what deserves the most instructional time. The use of computers has potential to save instructional time and make classrooms more efficient places. The meta-analysis by James Kulik of five hundred studies during the 1980s and 1990s found that students learned more in less time when using computer assisted instruction (Kulik, 1994). Schacter reports on a study of West Virginian students that found teachers had more time to teach in classrooms which implemented the state's computer assisted instructional program (1999). Other studies have shown that students learn the same amount of material in less time, when compared to students receiving traditional methods of instruction (Cotton, 1991).

Although this study did not examine students' attitudes towards completing mathematics tasks with a computer compared to traditional methods, it is important to note that other studies have demonstrated that computers have a tendency to improve students' attitudes towards mathematics, and school in general. Kulik (1994) found that students had more positive attitudes towards subjects which incorporated computer-based instruction. Others report similar findings; in their report on computer assisted technology, Sivin-Kachala and Bialo (2000) analyzed studies over the past 20 years and concluded that in almost every subject area, student attitudes changed positively when computer assisted instruction was used . Webster's 1990 study of African American students in Mississippi demonstrated a significant improvement in those students' attitudes towards mathematics after using computer assisted instruction, compared to

African American students in Mississippi that did not use computer assisted instruction (as cited in Sivin-Kachala & Bialo, p. 88). A 1992 study by Vanderbilt University found that students using computer software in mathematics class "showed [significantly] less anxiety towards mathematics, were more likely to see mathematics as relevant to everyday life, more likely to see it as useful, and more likely to appreciate complex challenges" (as cited in Sivin-Kachala & Bialo, p. 89).

Methodology

Sample and Population Demographics

My study took place in a rural, Midwestern, college town of approximately 9,000 people. The town employed a majority of workers in the agricultural industry, insurance industry, and higher education. Within the town were 17 churches, two institutions of higher education, and a public school system. There was also one private elementary school, a Christian school, which was the location for this study.

For participants, I used the entire population of the school. The school contained 27 pupils representing kindergarten through sixth grade students. Two full-time teachers, one paid teacher's aide, and one volunteer librarian were employed by the school. Each teacher had three years teaching experience. Twenty-three of the 27 students lived within the city lines; the four remaining students lived outside of town, but within 25 miles of the school. Twenty-five of 27 students were Caucasian, one student was African American, and one was Hispanic. Four of 27 students qualified for special education services in the public school system, if desired by parents. Two of those four were receiving special education services. The school was a private school and tuition at the time of the study was approximately $3000.00 per student. A discount of 10% was provided for each additional student from a family with more than one school-aged child. Tuition assistance was provided to 20% of the families.

The school was made up of 15 families. Of those parents who worked outside the home, 27% were employed in blue collar fields, 20% in computer/technical fields, and 53% were employed in professional fields.

The physical school building included a library/multi-purpose room, office, kitchen, art room, and two classrooms which contained the following number of students:

Grades K-2: 15 students

Kindergarten: 7

1st Grade: 5

2nd Grade: 3

Grades 3-6: 12 students

3rd Grade: 2

4th Grade: 3

5th Grade: 5

6th Grade: 2

The study sample was split up into two similar groups – Group A (control) and Group B (experimental). The national percentile rankings from the core mathematics scores of the Iowa Test of Basic Skills (ITBS) were used to divide students into either Group A or Group B. These scores were obtained from the 2002 ITBS, which students took during the spring of 2002. Students were divided by grade, so that wherever possible an equal number of students in each grade were present within each group. Within each grade, students ranking 1, 3, or 5 on the ITBS were placed within one group, and students ranking 2, 4, or 6 within the grade were placed within the other group. This procedure was alternated between the control group and the experimental group for each grade level. One student did not participate in the study due to being absent.

Instrumentation

The control group (Group A) used only traditional methods of math fact practice and instruction throughout the 10 day period of this study. Group A contained 13 students from kindergarten through sixth grade. Two of the thirteen students required special education services. Teachers were asked to record the amount of instructional time they spent on the teaching of mathematics facts on a provided time-log form (Appendix B, C).

The experimental group (Group B) used only MadMinute software for the duration of the study period (10 school days). Thirteen students participated within Group B and 2 of 13 had been identified as requiring special education services. Each student in Group B was required to use MadMinute software once per day, for 90 seconds. MadMinute automatically ended each session after 90 seconds of practicing mathematics facts. It stored all data internally, allowing data to be retrieved from the software and analyzed at a later time. MadMinute automatically adjusted each quiz to suit the strengths and weaknesses of each student. The program internally timed the length of each response during a quiz and in future quizzes provided more questions using the numerals students were slowest in responding to. For example, if students were slower responding to questions involving the numeral seven (7 x 1, 7 x 2, etc.) than they were responding to questions involving the numeral three (3 x 1, 3 x 2, etc.), MadMinute would adjust future quizzes by giving more questions using the numeral seven. Only one computer was present within each participating classroom, which meant that only one student at a time could take a MadMinute quiz within each classroom. Students took this quiz whenever they had free time within the allotted time slots (Appendix D). Students who were not taking quizzes were involved in the regularly planned activities of the school day.

Data Collection Methods

Competency results for the two groups were collected in the form of a pre study test and a post study test. The pretest was administered at the beginning of the 10 day study period, and the posttest was taken at the conclusion of the 10 day study period. The tests consisted of a sheet of paper containing math fact questions. Students in kindergarten through second grade received a sheet of 30 addition questions, while students in third through sixth grade received a page of 60 multiplication questions. All questions used addends and factors from the numerals one through nine. Students were given 60 seconds to answer as many questions as possible. The difference in correct responses between the pretest and posttest constituted the growth (or gains) achieved by each student. Competency was determined by comparing growth of the control group and growth of the experimental group.

Participating teachers recorded time data by filling in a daily log of the instructional time they used (in minutes) with the control group (Group A) and the experimental group (Group B) (Appendix B, C).

Data Analysis Methods

After completing the 10 day study period, the pretests and posttests were analyzed to determine the level of growth for each student from the pretest to the posttest. The mean difference of growth for the control and experimental groups was compared. A two tailed t-test was used to determine if the growth differences were of statistical significance.

Results

Results of Data Analysis

Table One

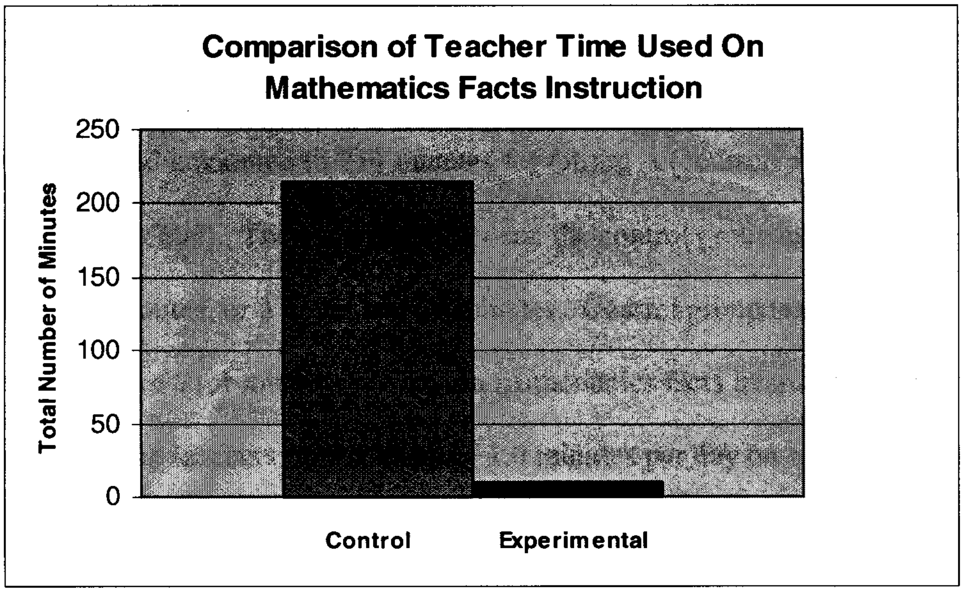
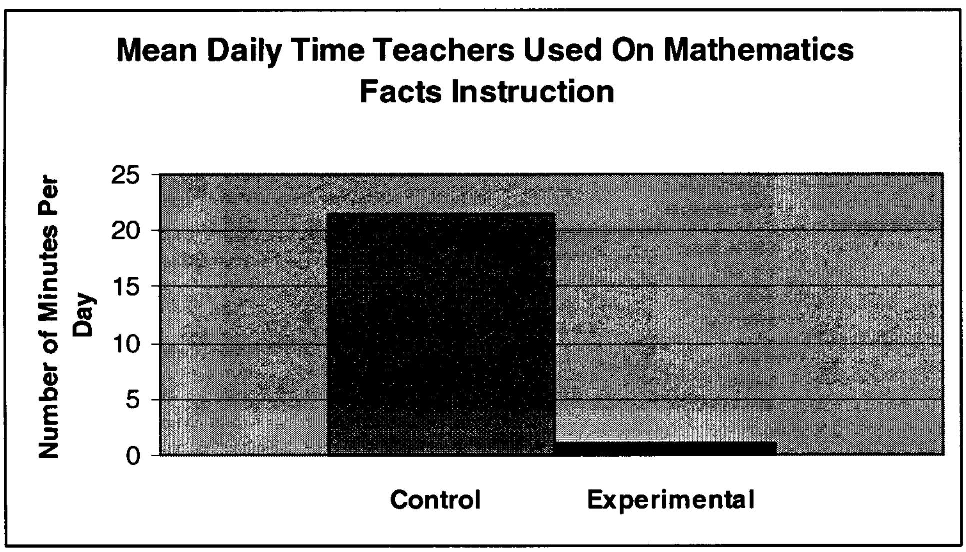


Table Two



Following the study period, each teacher's instructional time log forms were analyzed by totaling the amount of instructional time used for Group A (control group) and the total instructional time used for Group B (experimental group). The mean, daily instructional time was then calculated for both groups.

Instructional time.

Results showed that the total instructional time spent by teachers during the entire 10 day study period amounted to 214 minutes for Group A (control) and 10 minutes for Group B (experimental). The difference between the control group and experimental group was 204 minutes, or 3 hours and 24 minutes. Control group teachers used a mean instructional time of 21.4 minutes per day on mathematics facts instruction. Experimental group teachers used a mean of 1.0 minutes per day on mathematics facts instruction. Teachers in the experimental group saved an average of 20.4 minutes per day of instructional time, compared to teachers in the control group.

Table Three

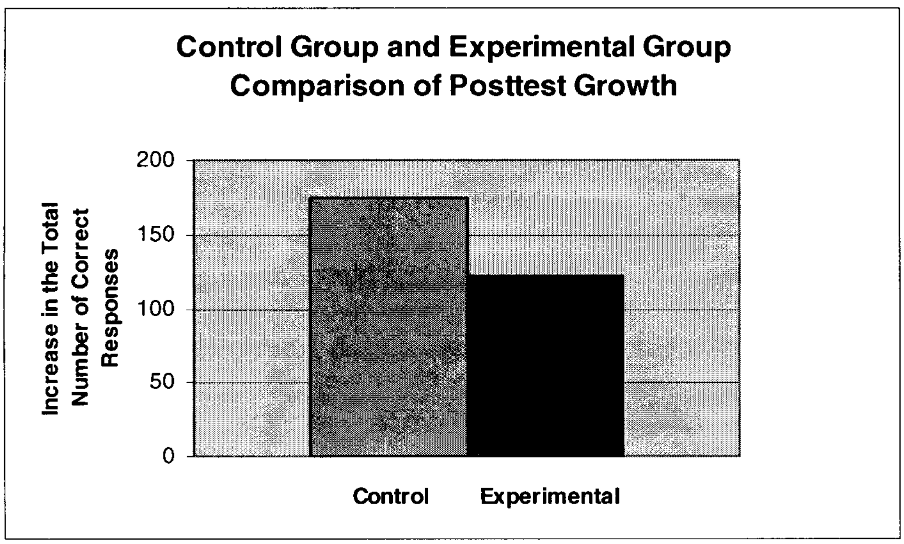
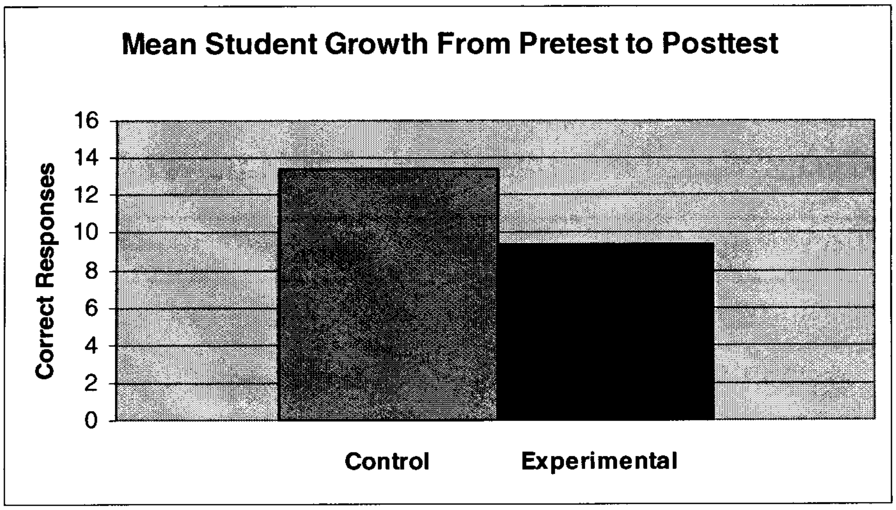


Table Four



Competency.

Analysis of the control group data showed that the mean gain from the pretest to the posttest was 13.5 correct responses. The control group gained 175 correct responses over the entire 10 day study. Students in the experimental group showed a mean gain of 9.4 correct responses from the pretest to the posttest. The experimental group gained a total of 134 correct responses over the course of the 10 day study. A two-tailed independent t-test was used to compare the mean scores of both groups.

Table 5 displays the results of the two tailed t-test. The null hypothesis of this study stated that student growth would show no significant difference between the control group and the experimental group, despite reduced mathematics facts instructional time dedicated to the experimental group. At a 0.05 level of confidence, with 24 degrees of freedom, the t value was determined to be 1.05, and the critical value of t was computed to be 2.06. Based on these results, the null hypothesis is retained – no statistically significant difference exists between the control and experimental groups. Random error cannot be ruled out as the cause of differences in the mean gains of both groups. Future studies will need to address this issue by increasing the sample size.

Table 5

Two-tailed t-Test Comparing Mean Student Growth Scores From Pretest to Posttest

Variable	Group	N	M	SD	df	t value
Mean growth scores from pretest to posttest	Control	13	13.46	11.27		
	Experimental	13	9.38	8.39	24	1.05

Summary and Discussion

Part I

Teaching elementary mathematics need not be a frightening experience. Too often, teachers of elementary mathematics experienced math phobia when they were students and remain somewhat intimidated by mathematics as teachers. As a result, many of our mathematics students learn the same fears and develop negative attitudes towards mathematics. This need not be. Mathematics can be challenging, but also highly creative, exciting, and hands-on. Computers can help teachers improve students' attitudes towards mathematics. Educational research has established that students' attitudes toward learning improve when they are able to use computers for instructional purposes (Sivin-Kachala & Bialo, 2000). Computers give teachers another tool to use in an effort to meet the needs of each student; furthermore, they provide some variety for students who tire of traditional textbook based instruction.

If we hope to make significant improvements in the way mathematics is taught at the elementary level, teachers must devote more time to exploring more creative ways to teach. However, teachers are pressured by the need to cover assigned material in a limited amount of time, and under such pressures it may be difficult to find the time to develop new, creative methods of teaching mathematics that go beyond the textbook. Too much of our teaching time is taken up by low-level, rote activities. Why should a teacher regularly spend twenty minutes helping students memorize basic mathematics facts when a computer can accomplish the same thing, with similar results, in far less time?

Teachers need not be threatened by this; computers are not going to replace real, live people in the classroom – far from it! Instead, I see the computer as having the ability to give teachers time to do what we really should be doing – teaching! Computers are excellent at providing activities that are drilled, memorized, and involve only low-level cognitive thought processes. By using computers more extensively teachers will have more time to develop teaching methods for mathematical concepts that require higher-level thinking.

As part of my Christian worldview, I believe that I am responsible for knowing each student as a whole people rather than as a collection of individual components that can be isolated and taught separate from the whole. I am better able to meet the needs of my students when I view them as whole, interwoven people because I become sensitive to other factors that might influence a student's life, such as family problems or health issues. I do not believe a student can be approached and taught as having an academic component that is uninfluenced by the world around them. Therefore, it is important for me to get to know each child in their world, on a personal level. By doing so, I can better understand the needs and motivations of my students, which allows me to effectively adapt my teaching to fit each student. Mathematics teachers must also recognize that no two students are the same, and as a result each student's educational needs are unique. MadMinute enables teachers to spend more time in creative, cross-curricular activities that connect mathematics to the world around us and provide deeper opportunities to develop meaningful relationships with students.

Teachers walk a fine line in attempting to find a balance between teaching methods that are highly effective and those that use limited class time in an efficient manner. Teaching methods that engage students in hands-on activities are usually more time consuming than textbook based activities that drill algorhythms through repeated practice questions. In mathematics, I attempt to show my students how math is interconnected with the world around them. In my opinion, textbooks do not provide enough creativity to address the unique strengths and weaknesses of my students and do not demonstrate effectively the interconnectedness of life and the universe we live in. MadMinute software may prove helpful to elementary mathematics teachers because it is an efficient tool that can replace more time consuming drills typically accomplished with a mathematics textbook or worksheets. The results of this study indicate that a significant amount of time can be saved when students use Mad Minute – time that can be devoted to activities that are more effective and creative than might otherwise be used.

The purpose of my study was not to prove that computers do a better job of teaching basic math facts compared to real teachers. Instead, I simply wanted to explore whether the MadMinute software could free up instructional time each day for teachers to do other things. Clearly, the answer to that question is yes.

In the control group, teachers spent 214 minutes teaching basic math facts over the course of the 10 day study. In comparison, the experimental group used 10 minutes of instructional time to teach basic math facts. Please note that this study did not focus on the amount of time students devoted to practicing basic mathematics facts. Instead, the focus was on the amount of instructional time teachers needed to teach basic mathematics facts. However, it is easy to deduce an approximation of the amount of student time devoted to practicing mathematics facts during the study period. Students in Group A, the control group, were directly instructed by the teacher and were required to practice mathematics facts for the duration of the teacher-directed instructional time, which amounted to a mean of 10.7 minutes per day. However, students in Group B, the experimental group, were individually responsible for practicing basic mathematics facts – the teacher gave only verbal reminders to use the MadMinute software daily, and directly instructed students only when asked by a student, or when the teacher observed a problem. As a result, each student in Group B practiced mathematics facts for a mean of 90 seconds per day using MadMinute software, while the teacher was able to use most of the other available time for instructional activities intended to build conceptual understanding. Teachers in the experimental group had an average of 20.4 minutes per day of extra teaching time.

The power of the MadMinute software is that students use it during their down time. That is, time when they are looking for something to do or waiting for the next class (or recess) to begin. The student question, "What should I do now?" should cease to be a part of our classrooms. I found that students who were required to use MadMinute every day during any down time they had were almost always able to find the time to take their quiz. This allowed me to minimize the use of precious scheduled instructional time to teach mathematics facts.

MadMinute software can provide a more efficient method for helping students learn their mathematics facts than traditional methods. During this 10 day study, students in the experimental group did not show higher levels of growth compared to those in the control group. Further study would be needed to determine the effectiveness of computer-assisted learning and to examine the long-term effectiveness of substituting computer-assisted instruction for traditional methods.

Another powerful benefit of using MadMinute software is the ownership students take in learning their mathematics facts. Because the teacher's involvement in MadMinute is limited to initially setting up the program and monitoring results on a weekly, bi-weekly, or monthly basis, the students are forced to take much more personal responsibility in learning their mathematics facts. As described in the Review of Literature, many studies show that students' attitudes toward learning improve when computer assisted instruction is used. Computers are infinitely patient, do not get angry when mistakes are made, and do not embarrass students in front of the class. As studies have shown, students appreciate these features of computer assisted learning. Improved attitudes towards mathematics may help to reduce the number of students who drop out of mathematics when it becomes an elective, and reduce the number of adults who feel a degree of math phobia.

The extra instructional time afforded to teachers who use MadMinute software would be deemed irrelevant if MadMinute was not effective in helping students reach a level of automaticity. Results of this study showed growth differences to be statistically insignificant, demonstrating that from a statistical perspective, MadMinute was as effective as traditional methods in helping students learn mathematics facts.

In this study, students in Group B used MadMinute for a mean of 90 seconds per day. However, the software is designed to be customizable by teachers, thus enabling teachers to increase or decrease the amount of time each individual student spends on MadMinute. It would be interesting to study what effect increasing student time on MadMinute from 90 seconds to 120 seconds would have on the growth difference between the control and the experimental groups.

Of course, a major limitation of this study was the small sample size. This study should only be considered an initial study of the potential of MadMinute software to increase instructional time for teachers. The study may also serve as a springboard for discussions on how we can reduce the amount of instructional time teachers spend on low-order thinking skills and drill and test activities so that more time can be spent on conceptual, hands-on learning that encourages higher-order thinking. Mathematics can be a creative, exciting, and enjoyable subject to teach. Teachers need not be afraid to explore a hands-on, creative approach to teaching mathematics. MadMinute is a tool teachers can use to allow themselves more time to teach mathematics creatively.

Part II

On August 14, 2004 my wife and I moved from the Midwest of the United States to Kyiv, Ukraine, where we began teaching at Kyiv International School. Kyiv International School uses English as the primary classroom language; however, many students at Kyiv International School are not native English speakers. This unique opportunity provided me with another outlet to test my hypothesis regarding MadMinute software. Although I only collected data informally, an anecdotal report may prove useful to this study.

Kyiv International School has approximately 275 students in preschool through grade twelve. My first grade class consisted of 12 students; only one of those students spoke English as their native language. Of my 12 students, nine were identified as requiring Intensive Education, which provides extra English classes for students whose English language capabilities are very low. My students came from nine different countries: India, South Korea (two), Spain, Poland, Ukraine (three), Kenya, Japan, United States, and Azerbaijan. My full-time cooperating teacher was Ukrainian.

I was fascinated to discover the usefulness of MadMinute software with my first grade students. The school year provided many surprises and challenges, especially because I had never taught students who did not know English fluently. At times, communicating with my students was difficult. At the beginning of the year, three of my students knew less than 50 English words, which challenged me to be more creative in how I taught. The MadMinute software was helpful because it required very little English language skills to master the program. The children intuitively understood their task when using MadMinute, and they needed only minor instructions on how to start and end the program. My students became very excited about using MadMinute software and asked me daily when they would be able to use it again. I believe they enjoyed the program so much because they understood it – it was comfortable to them because it was so intuitive and required minimal language skills. The students also enjoyed the challenge of competing against themselves by trying to better their previous day's score. I found this type of competition to be much more rewarding and valuable than the student-to-student competition that paper and pencil math fact quizzes and "Around the World" type games so often promote.

In addition to the above benefits of using MadMinute with my English language learners, I was also impressed by how easy it was for me to adjust the MadMinute software to meet the individual needs of my students. My Christian worldview influences the decisions I make in my life, including decisions about teaching methods and how I relate with my students. In keeping with my belief that all children are created unique and given unique strengths and weaknesses, MadMinute allows children to advance their skills at a pace less influenced by their peers. Children learn and develop at different speeds, and I was easily able to adjust the software so that all my students were appropriately challenged without being overwhelmed or bored. Furthermore, MadMinute removes some of the negative competitive element that often leaves the same group of children feeling disappointed after participating in games such as *Around the World* or paper quizzes.

In the end, my own experiences with MadMinute software during my first year at Kyiv International School confirmed my original thoughts that the software saves significant amounts of teaching time compared to teaching children basic, memorized mathematics facts using traditional methods. The amount of instructional time saved in Kyiv was increased because students did not need to understand much English in order to use MadMinute software. As a result, they were able to learn mathematics facts faster than English language learners who were taught in traditional ways; this allowed me to use the extra instructional time to work more closely with individual students.

I am encouraged that as conceptual, hands-on learning becomes more common in elementary mathematics classes, more students will be eager to continue studying mathematics in high school and college. It is my hope that this study might lead others to explore ways to improve the use of instructional time in mathematics classrooms so that more of our students will learn to love math.

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Appendix A

<u>Instructions for Math Facts Study:</u>

1. Please document your time on the provided sheets as accurately as possible. Indicate the time spent preparing, teaching, and assessing math facts. Also, please indicate specifically what you were doing during that time. For example: "7 minutes: practiced flash cards with students," or "4 minutes: graded student quizzes," or "2 minutes: prepared flash cards/quiz materials, or "8 minutes: students graded own quizzes."

2. On the first day of the study, please explain to the students that they will be helping teachers to learn about how children learn their math facts. Explain that it is very important that everyone does their very best each day. The study will last for 10 school days.

    a. For those in Group A, explain that they will be practicing using flash cards and written quizzes. It is very important that they do their best work.
    b. For those in Group B, explain that they will be practicing using MadMinute on the computer. It is very important that they take 1 quiz EVERY day. They should NEVER skip a day and they should never take more than one MadMinute quiz per day.

3. For Group A, you are free to use flash cards and written quizzes in any way you would like, as long as you document how they're being used.

4. For Group B, it is not important when students take their MadMinute quiz each day, as long as they take one quiz at some point during the day.

5. On the first day of the study, give all students the provided pretest. Likewise, on the final day of the study give all students the provided posttest. I will grade these quizzes.

6. Please see me if you have any questions during the study.

7. Thank-you very much for your help!

Appendix B

Directions: Please document time spent on mathematics facts related tasks (see Instructions for more details)

Group A: Traditional Math Fact Instruction

Day 1	Day 2	Day 3	Day 4	Day 5

Day 6	Day 7	Day 8	Day 9	Day 10	Totals

Appendix C

Directions: Please document time spent on mathematics facts related tasks (see Instructions for more details)

Group B: Mad Minute Software

Day 1	Day 2	Day 3	Day 4	Day 5

Day 6	Day 7	Day 8	Day 9	Day 10	Totals

Appendix D

Times Available for Taking MadMinute Quizzes

K-2 Classroom

Kindergarten	8:00 – 10:15
1st Grade	10:15 – 12:30
2nd Grade	12:30 – 2:45

3rd-6th Grade Classroom

3rd and 4th Grade	8:00 – 11:30
5th and 6th Grade	11:30 – 3:00

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Jeremy Tinsley was born in Abbotsford, British Columbia, the son of Clare and William Tinsley. Following high school, he attended Dordt College in Sioux Center, Iowa, from 1995-1999. There, he earned Bachelor of Arts degree with a major in elementary education. Jeremy Tinsley entered the graduate education program at Dordt College during the summer of 2000.

From 1999-2003 Jeremy Tinsley was employed as a multi-grade elementary teacher at Central Iowa Christian School. He was awarded the Grinnell-Wal Mart Teacher of the Year award in 2003. He moved with his wife, Jennifer, to Kiev, Ukraine, during the summer of 2003, where he is presently teaching first grade at Kyiv International School.

Jeremy Tinsley has published one article, The Lord Watches Over You, a contribution for the book *From Generation to Generation: Celebrating 50 Years at Abbotsford Christian School* (2003).