# Math Fluency Intervention Using Technology

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# Introduction

## Orientation to the Topic

Developing and investigating strategies to increase mathematics fluency in children is imperative with the implementation of the Common Core standards. What is mathematical fluency? Math fluency is the ability of a student to recall quickly addition, subtraction, multiplication, and division facts (Frawley, 2012). With all of the technology available, it is important to establish a relationship between math fluency and technology in order to ensure students have this skill.

Many educators are using technology as an intervention tool in their classrooms. Technology devices such as iPads are relatively inexpensive and versatile for student and classroom use. Technology allows for students to learn and deeply understand mathematical concepts while using technology. It is important to use the technology resources I have available in my classroom to increase fluency with all of my students. I am currently teaching third grade math. I have been teaching math for four years. In my experience, I have realized students have minimal fluency in math when it comes to addition and subtraction. Without being fluent in addition and subtraction, students will have a difficult time with mathematics in third grade. With the new Common Core standards, students are expected to be fluent in basic addition and subtraction facts by this time. It is important to outline the reasons why students are not fluent and determine methods which will increase fluency in early grades and prepare them for upper elementary math.

With the changing world of education, it is important for educators to begin to change also. By using technology in the classroom, it is possible to greatly increase students' math fluency which will benefit them throughout their lives.

**Purpose Statement**

The purpose of this research is to determine effective instructional technology programs that will promote students' math fluency. All teachers wonder how much time and planning these interventions take. Once a program has been determined and directions given to students, the teacher has a minimum amount of time invested into the intervention. With the technology playing the role of the facilitator, the student will be working individually to increase fluency.

With Common Core standards increasing in rigor, students must have the basic skills before they can be expected to excel at a higher level. By providing these simple math fluency interventions, students will be ready to reach maximum potential in a short amount of time.

**Research Questions**

During this process, there are several questions which will be important to answer. First, will Renaissance Accelerated Math be successful for students when conducting technology interventions? Renaissance Accelerated Math is a program in which the teacher chooses objectives or standards students need to work on. Then, students complete practices and tests to master those standards. The work can be set up as standardized testing format or student response. Depending of the type of learner, the program may need to be adjusted. Also, students with special needs would need to be accommodated also. Renaissance Accelerated Math is set up to accommodate all learners. Next, a time frame will need to be established. Most of this will depend of the educator. The interventions will take place 10 to 15 minutes per day for four

weeks. In addition to this, the educator will need to determine the technology available to them. With this being said, the experimental group will use laptop computers during their interventions. The control group will use iPads for their intervention time. Renaissance will automatically track the growth of students and show it using various reports. At the end of each week, students will be given a mixed multiplication check in order to determine if they have made any growth over the time period.

**Importance of the Study**

This study is extremely important to any educator teaching mathematics. The study will reveal whether or not conducting an intervention using Renaissance Accelerated Math will help students achieve higher levels of mathematical fluency. This study could change the way educators are teaching. It could also provide educators with other resources to help students achieve maximum fluency. It is important for educators to use technology in the most productive ways. By using technology to provide interventions for students trying to obtain math fluency, students could have a better chance of success in mathematics. In order for these interventions to be successful, it is important for educators to choose appropriate programs which will help their students achieve goals. Also, providing a schedule for the intervention is also imperative. With the many types of technology in classrooms today, providing math fluency interventions using technology should be both successful for the student and the teacher.

**Definition of Terms**

**Renaissance Accelerated Math** is the math program used for the study. The program can be used as a progress monitoring tool to help increase students' fluency in mathematics.

**Intervention** specialized one on one session where students' focus on a subject area where they need specific help.

**Intervention Specialist** is a certified teacher trained to help students' focus on reading and math

## Literature Review

Sarama and Clements (2004) outlined the importance of students developing math fluency at an early age. They indicate this goal will enable students to be more successful in the future. Research also shows a direct link between technology interventions and improvements in mathematics (O, Jenkins, Wesley, Donehower, Rabuck & Lewis, 2013). How does technology based interventions such as Renaissance Accelerated Math influence math fluency?

### Technology and Math Fluency

In the process of mathematics, two things should be considered. First, teachers need to help children build their computational fluency; secondly, teachers need to allow students to focus on and have a deep understanding of problem solving (Kuhn & Dempsey, 2011). According to a study conducted by Kuhn and Dempsey, if students find something which is exciting i.e. using an iPad, they will be more engaged and find it more relevant to their lives.

According to a second study by Cholmsky (2011), he suggests students need fluency in math in order to free up other working memory which allows them to focus more of the problem solving aspect of math. Cholmsky (2011) suggests using a technology program called Reflex Math helps students who are having trouble mastering their math facts achieve them. By using this technology, students are doing four things: participating in fun, engaging lessons, lessons which are adapted to their needs, progress monitoring, and ultimately mastering facts.

Adding to the study by Cholmsky (2011), Duhon, House, and Stinnett (2012), also investigated the effects of computer based instruction in mathematics. Their findings indicated students had higher achievement in all areas of mathematics when using computer based interventions. In a comparison of teachers who used pencil and paper techniques to help students

become fluent in math facts vs. teachers who used technology, the students using technology were more successful in their math fact fluency. Schwartz (2005) identifies many instructional strategies teachers can use to help their students build the basic blocks of math. These instructional strategies can be used with technologies such as iPads or classroom computers. There are many tutorials and programs such as FASTT Math (2012), which will allow students to be successful in building fluency using the basic instructional strategies such as counting on that many educators are teaching.

**Literature on Math Foundation**

There are many opinions from educators indicating the foundations of math skills students need in order to be successful. I chose to focus on the skills students learn in elementary school. To be specific, the skill I chose to address is the fluency skills students have in multiplication. According to an article from the National Council of Mathematics Teachers (2007), the council urges teachers to focus on the early math skills in order to ensure the success of students. To name a few, these skills included reasoning, problem solving, and fluency. Schwartz (2005) also identified many instructional strategies which are essential to success of children in early mathematics. Another article from the NCTM suggests developing a positive attitude and essential math skills from pre kindergarten through second grade is imperative in the success of children in mathematics. It is important for children to know what math is, how it is important, and how it affects them. The article, "The Basics of Math" identifies specifically things children should be able to do in primary math. One objective which is mentioned each year from kindergarten through second grade is computation of addition and subtraction problems efficiently. Another objective is mastering basic math facts.

## Methodology

The setting for the study is West Fannin Elementary School located in Blue Ridge, GA. The school has approximately 480 students. The study took place specifically in the third grade. There are 72 students in the third grade. Of the 72, 20 participated in the study,10 girls and 10 boys. These students range in age from eight to ten. All third-graders see have one math teacher. In each math class, there is one parapro.

To begin the research, students were given a pre-test. This test consisted of 100 mixed multiplication problems with products up to 144, and it was developed based on Common Core standards. At this point, students have been taught multiplication strategies. Scores from the pre-test were recorded. The following days, students were given 10 to 15 minutes each class period to practice multiplication facts using technology. Ten students were randomly selected to participate by using technology. The remainder of the students completed their multiplication practice on paper each day. The available technology was Ipads and desktop computers. Students were rotated on and off the technology so each student was given the same amount of time each day. Students received the additional multiplication practice for 20 school days. At the end of each week, the score was recorded showing whether the students had made any gains or losses with their facts. This was determined by a test the students were given every Friday. The test was exactly like the pre-test they were originally given.

To conclude the study, students were given a final post-test to determine if technology does increase multiplication fluency. This test also consisted of 100 mixed multiplication problems with products up to 144. The tests were graded and score were recorded and compared to prior scores.

**Overview of Research Design**

The research method being used for this study is quantitative research. Quantitative research measures the views from a particular sample. Usually, the sample population is chosen randomly. With this being said, the sample population chosen for this study will be random. Selecting a sample is important. In this study, a random sampling method will be used. In random sampling, all individuals have an equal chance of being selected. The population in which the sample will be chosen from is any elementary school student. The desired sample size will be no less than ten students and no more than twenty students. The participants will be randomly assigned a number for data tracking purposes.

**Analysis**

The data collected during this study is quantitative data. There were two groups of students: one controlled and one experimental. The control group remained in the classroom practicing math fluency using traditional methods such as pencil and paper practice. The experimental group practiced using technology.

The initial pre-test (Appendix A) consisted of 100 mixed multiplication problems with products ranging up to 144. The problems were not numbered and were listed in rows. Each problem was worth 1 point in value. The number of problems students completed correctly were counted. If they were incorrect, they were not counted. The pre-test scores were recorded in a table (Appendix B) where the average could be determined. Students were given the same test an additional four times throughout the study. Each time the test was administered, additional scores were recorded in the table (Appendix B). From the results on the table, it seems apparent many students made significant gains. However, there are students who did not make any gains, and at

time times, actually lost in problems completed correctly. On the 21st day, the post-test was administered to all 20 students. The final score was also added to the table (Appendix B). The results were recorded in order to find the mean, mode, and median for each student. The data was also entered into a paired *t*-Test to determine gains (Appendix C).

**Conclusion**

After gathering all of the data, the average number of problems answered correctly during the study is 42.5. The minimum number of problems answered correctly was 8 with a maximum of 82. Both the median and the mode were 46 questions, with a range of 74. The *t*-Stat was -8.4. The *t*-critical one tail was is 1.7. The *t*-critical two tail was 2.1. Therefore, there were gains made; however, not as substantial as I had hoped.

References

Basics of mathematics. (2002). Retrieved from http://www.pbs.org/wgbh/misunderstoodminds/mathbasics.html

Cholmsky, P. (2011). Reflex math. Retrieved from http://www.reflexmath.com/assets/doc/Reflex_White_Paper.pdf

Creswell, John W. (1994) *Research Design: Qualitative and Quantitative Approaches*; Sage Publications; California.

Developing a solid math foundation. (2004). Retrieved from http://www.todays-learners.com/developing-a-solid-math-foundation/

Duhon, G. J., House , S. H., & Stinnett, T. A. (2012). *Evaluating the generalization of math fact fluency gains across paper and computer performance modalities. Journal of School Psychology, 50(3), 335-345 inclusive*. Retrieved from http://www.sciencedirect.com.proxy.kennesaw.edu/science/article/pii/S0022440512000179?

Falloon, G. (2013). *Young students using ipads: app design & content influences on their learning pathways. Computers & Education, 68, 505-521 inclusive*. Retrieved from http://www.sciencedirect.com.proxy.kennesaw.edu/science/article/pii/S0360131513001577?

Frawley, Chris (2012). Innovations and Perspectives. Retrieved from http://www.ttacnews.vcu.edu/2012/02/developing-math-fact-fluency/

Godzicki, L., Godzicki, N., Krofel, M., & Michaels, R. (2013). Increasing motivation & engagement in elementary & middle school students through technology supported learning environments. Retrieved from http://files.eric.ed.gov/fulltext/ED541343.pdf

Helmenstine, T. (2013). *What is a control group?*. Retrieved from http://chemistry.about.com/od/chemistryterminology/a/What-Is-A-Control-Group.htm

Hudson, S., Kadan, S., Lavin, K., & Vasquez, T. (2010). Improving basic math skills using technology. Retrieved from http://files.eric.ed.gov/fulltext/ED512698.pdf

Kuhn, M., & Dempsey, K. (2011). End the math wars. Retrieved from http://files.eric.ed.gov/fulltext/EJ954321.pdf

O'Malley, P., Jenkins, S., Wesley, B., Donehower, C., Rabuck, D., & Lewis, W. (2013). Effectiveness of using ipads to build math fluency. Retrieved from http://files.eric.ed.gov/fulltext/ED541158.pdf

Pavlekovic, M., Kolar-Begovic, Z., & Kolar-Supera, R. (2013). Mathematics teaching for the future. Retrieved from http://files.eric.ed.gov/fulltext/ED542544.pdf

PR Newswire. (04, 2012). All new fast math: Next generation helps students achieve math fact fluency. Retrieved from http://ehis.ebscohost.com.proxy.kennesaw.edu/eds/detail?sid=c4e9d776-b9ce-4fca-94c5b002b08f037f%40sessionmgr4&vid=5&hid=17&bdata=JnNpdGU9ZWRzLWxpdmUmc2NvcGU9c2l0ZQ%3d%3d#db=bwh&AN=201204250959PR.NEWS.USPR.NY94595

Sarama, J. & Clements, D. (2004). Building Blocks for early childhood mathematics. Retrieved from http://gse.buffalo.edu/org/buildingblocks/writings/bb_ecrq.pdf

Schwartz, S. (2005). Teaching young children mathematics. Retrieved from http://www.questia.com/PM.qst?a=o&d=113141063

What is important in early childhood mathematics. (2007, September). Retrieved from http://www.nctm.org/about/content.aspx?id=12590

Webb, J. (2013). The ipad as a tool for education. Retrieved from http://www.naace.co.uk/publications/longfieldipadresearch

# Appendix A

## Table of Student Tests

| Student | Pre-Score | Adminstration 1 | Administration 2 | Administration 3 | Administration 4 | Post-Test |
|---|---|---|---|---|---|---|
| **B1** | 50 | 51 | 49 | 85 | 91 | 100 |
| **C1** | 42 | 65 | 65 | 49 | 82 | 95 |
| **D1** | 59 | 62 | 63 | 68 | 70 | 72 |
| **E1** | 14 | 14 | 26 | 37 | 41 | 42 |
| **F1** | 18 | 21 | 30 | 30 | 42 | 49 |
| **G1** | 51 | 56 | 56 | 62 | 68 | 67 |
| **H1** | 26 | 28 | 32 | 54 | 68 | 69 |
| **I1** | 44 | 26 | 53 | 75 | 64 | 87 |
| **J1** | 72 | 73 | 75 | 80 | 82 | 87 |
| **K1** | 61 | 84 | 85 | 85 | 85 | 85 |
| **L1** | 19 | 12 | 48 | 52 | 58 | 65 |
| **M1** | 8 | 16 | 17 | 13 | 20 | 25 |
| **N1** | 15 | 20 | 23 | 34 | 39 | 46 |
| **O1** | 46 | 32 | 43 | 45 | 49 | 58 |
| **P1** | 43 | 50 | 65 | 82 | 84 | 93 |
| **Q1** | 82 | 85 | 85 | 93 | 91 | 100 |
| **R1** | 46 | 52 | 56 | 64 | 62 | 75 |
| **S1** | 66 | 70 | 78 | 84 | 82 | 79 |
| **T1** | 47 | 53 | 36 | 52 | 54 | 58 |

## Appendix B

## Results of Study

| | |
|---|---|
| **Mean** | **42.57895** |
| **Standard Error** | 4.823381 |
| **Median** | 46 |
| **Mode** | 46 |
| **Standard Deviation** | 21.02463 |
| **Sample Variance** | 442.0351 |
| **Kurtosis** | -0.75859 |
| **Skewness** | -0.0451 |
| **Range** | 74 |
| **Minimum** | 8 |
| **Maximum** | 82 |
| **Sum** | 809 |
| **Count** | 19 |

## Appendix C

## *t*-Test Results

| ***t*-Test: Paired Two Sample for Means** | | |
|---|---|---|
| | | |
| | *Variable 1* | *Variable 2* |
| **Mean** | 42.6 | 71.2 |
| **Variance** | 442.0 | 443.9 |
| **Observations** | 19.0 | 19.0 |
| **Pearson Correlation** | 0.8 | |
| **Hypothesized Mean Difference** | 0.0 | |
| **df** | 18.0 | |
| **t Stat** | -8.4 | |
| **P(T<=t) one-tail** | 0.0 | |
| **t Critical one-tail** | 1.7 | |
| **P(T<=t) two-tail** | 0.0 | |
| **t Critical two-tail** | 2.1 | |