Assisted Technology in the Mathematics Classroom

Does the Classworks program increase standardized test scores?

Heather R. Brown

Kennesaw State University

**Introduction**

**Orientation to the Topic**

According to the Georgia Department of Education (2013), the Criterion-Referenced Competency Test (CRCT) was created to determine how students comprehend and apply grade-level state standards related to the academic content areas. The state of Georgia requires that all students in grades three through eight take the CRCT in certain academic content areas. In the academic content areas of mathematics and reading, all students in all grades are required to take both sections of the assessments and must pass both of these portions with an 800 to be promoted to the fourth, sixth, and ninth grade.

In the Colquitt County School district, middle school students are placed in classes based on their CRCT scores from the previous year. Students who scored an 810 or below on the math portion of the CRCT are placed in a math support class. The math support class is taught during a connections class. The connections classes are taught on block schedule. The blocks are one hour and twenty minutes long and taught every other day based on the odd or even number of the school day. The classes have a mixture of regular and special education students and many of the students are taught in a co-teaching setting in their academic math class. In the math support classes, the students are taught by a certified teacher. The teacher provides support based on the Common Core Georgia Performance Standards (CCGPS). During the class, the students are offered remediation through teaching and a computer-assisted technology program. The computer-assisted technology program used at Williams Middle School is called Classworks.

**Purpose Statement**

The purpose of this research is to determine if co-taught seventh-grade students who complete Classworks in a math support class score higher on the math portion of the CRCT in comparison to seventh-grade co-taught students not in a math support class.

**Research Questions:**

1. Do co-taught seventh grade students who completed Classworks in math support class in the sixth grade score higher on the math portion of the CRCT than co-taught seventh grade students who are not enrolled in math support class?
2. What are students’ perceptions of the Classworks program?

**Importance of the Study**

This research study provides statistical proof between the uses of assisted technology programs, like Classworks, and how well students performed on standardized tests. From this study, the school will be provided with statistical data that shows the difference in standardized test math scores of co-taught students who took math skills class in the sixth grade, using Classworks and co-taught students who are not in a math skills class. During my research, the Classworks program was not used in any of the studies from the literature. This study allows literature to be written on this program to fill the gap in the literature.

**Definition of Terms**

According to Dictionary.com (2013), computer-aided instruction, also known as computer-assisted instruction, is “the use of computers for education or training.” Based on the definition provided by Classworks Curriculum Advantage Inc. (2013), Classworks is a “web- based curriculum resource in mathematics, reading, language arts, and elementary science.” Co-teaching is defined, by the Curry School of Education (2012), as ”involving two equally-qualified individuals who may or may not have the same area of expertise jointly delivering instruction to a group of students.”

**Literature Review**

**Literature on Methods of Teaching Math with Assisted Technology Instruction**

According to Taj & Sivalingam (2013), computer assisted instruction allows learners to learn mathematics through the use of the computer acting as a “tutor and tool” (p.2).As the use of computer assisted instruction increases in the classroom; students will enjoy the use of the technology and be able to learn the math concepts on their own. In the study by Taj & Sivalingam (2013), students were divided into two groups to compare the best method for teaching math. The methods compared were computer assisted instruction and the traditional instruction method. During the teaching process, the students were taught the math concept fractions. The students completed a pre-test and post-test and the scores for both groups were compared. The results for this study showed that the average post-test scores were higher for the computer assisted instruction group meaning that students were able to learn the math concept better using the computer program.

In the United States, teachers in all content areas are expected to use several types of technology as they teach in their classroom. According to Frye and Dornisch (2008), technology allows the students to participate in ways of learning content that is interactive and students prefer teachers that teach using technology. Frye and Dornisch (2008) completed a study to determine if teachers were capable of using technology in the classroom and if the technology was used more in math and science classrooms. During the study, a group of 101 high school students from different places in the world were asked to answer a series of questions about themselves, one of their teachers, and give their thoughts on one of their content classes. In the analysis of the study, Frye and Dornisch (2008) stated that 52% of the participants answered the questions about a math or science class and the remaining 48% focused on English or Social Studies. The results concluded that math or science teachers who used technology in their classrooms improved the student’s content knowledge, added motivation, and improved the student’s outlook of the subject and teacher.

**Literature on Use of Assisted Technology Instruction in Math Classrooms**

In the study by Leh and Jitendra (2012), a group of 25 third-graders were selected to participate in an additional mathematics course that focused on solving word problems. The students were selected based on their state test scores from the previous year. During the study, the students were split into two groups. The students were taught how to solve word problems through computer-mediated instruction and teacher-mediated instruction. Both types of instruction provided students with an explanation of the problem-solving process that needed to be used to solve the word problem. According to Leh and Jitendra (2012), “a review of the two programs revealed that they are more similar than different with regard to instructional practices” (p. 70). The results showed that there was not a significant increase in final results for either type of mediation. The results indicate that neither way of teaching is more effective than the other.

In the study conducted by Rasanen, Salminen, Wilson, Aunio, & Dehaene (2009), a group of students were selected to participate in a comparison study. Each group was chosen based on their understanding of number skills. According to Rasanen et al. (2009), “many components of cognitive processing have been connected to poor performance in mathematics” (p. 451). During the study, the groups participated in two mathematical games during a three week period. The computer assisted programs concentrated on the math concepts of counting, number sequencing, and comparing an object amount to the written number form. The programs were similar in comparison to the tasks that the students had to perform. Rasanen et al. (2009) stated that the programs differed from each other by how the numbers were compared to each other. After the completion of the study, Rasanen et al. (2009) concluded that the results from each group showed no greater average score for each group. These results indicated that the computer-assisted programs were not affective in meeting the criteria for this type of instruction.

According to Periathiruvadi and Rinn (2012), there are many ways of teaching gifted students in the United States. Periathiruvadi and Rinn (2012) stated that “ technology not only allows teachers to provide differentiated instruction for gifted children and adolescents, but also serves as an educational and creative outlet for some of the best and brightest minds in the world” (p. 153). This article focuses on empirical research that is associated with teachers using technology to teach gifted students. The results from Periathiruvadi and Rinn’s (2012) research showed that gifted students had a better understanding of the content when technology was used in the classroom with an emphasis of learning online.

**Literature on Programs for Assisted Technology Instruction Used in Math Classrooms**

The use of technology in math classrooms allows students the opportunity to learn in many different ways. Teachers are able to provide more activities and opportunities for the students to learn. According to Meletiou-Mavrotheris and Mavrotheris (2012), the use of “computer games are a tool for supporting mathematics teaching and learning” (p. 455). During this study, a group of 13 students during their final year of college were selected to complete a unit on learning mathematics through game-enhancing. Meletiou-Mavrotheris and Mavrotheris (2012) concluded that the game-enhancing learning did have a positive impact on a teachers’ ability to choose and apply to online game to their instruction.

In the research article by Slavin and Lake (2007), three approaches to teaching math are examined. The approaches focused on are teaching with a text book, using computer-assisted instruction programs, and how a teacher manages a classroom and their practices for instruction. During this study, Slavin and Lake (2007) use a technique called “best-evidence synthesis” (p. 6). This technique “seeks to apply consistent and well-justified standards” that provides information that is appropriate and fair from experimental studies (p. 6). Each study focused on whether each program met the “criteria for inclusion” (p. 7). The “criteria for inclusion” included 6 mandatory guidelines. The results of the study showed that 87 of the studies complete met the criteria for inclusion. Of the 87 studies, classroom management and practices for instruction showed a higher effect on teaching math. The second highest effect was the use of computer-assisted instruction programs and teaching out of text books saw no change in the study.

**Literature on Levels of Achievement when Using Assisted Technology Instruction in Math**

Problem- solving skills are crucial for all levels of students when they are solving word problems. According to Huang, Liu, and Chang (2012), problem-based learning-PBL allows students to learn from their own explorations, collaborate with their peers, motivate their peers to enhance learning, and develop problem-solving skills. Polya’s process for problem solving ( as cited in Huang, Liu, & Chang, 2012) introduced this process as a strategy for PBL. The steps for Polya’s problem-solving method is to understand the problem, develop a plan, carry out the plan, and look back. In the study by Huang, Liu, and Chang (2012), a group of second and third-graders, who showed difficulties in math, were asked to navigate through a computer-assisted program on a website. The program focused on solving addition and subtraction word problems. During the completion of the program, the students were instructed to focus on the four steps for problem solving. The result for the study by Huang, Liu, and Chang (2012), showed that “the computer-assisted mathematical learning system can serve as a supplementary tool that can help teachers with remedial instruction and enhances the problem-solving ability of low achievers” (p.258).

According to Tienken and Maher (2008), “the issue of lower than expected mathematics achievement is a persistent worry to some education leaders and policy makers at all levels of the U.S. PK-12 education system” (p. 1). In this study, students’ state scores from an eighth-grade math class in New Jersey are being compared to determine if there is an increase in achievement. To determine the difference, the students are divided into two groups. The groups include whether the students received computer-assisted instruction- CAI or no CSI during the presentation of the math content standards. The results for this study by Tienken and Maher (2008) showed that there was not a dramatic increase in the test scores for students who participated in CAI.

In this study, Lee, Waxman, Wu, Michko, and Lin (2013) provide an outlook of how students achieve in practices of instruction when technology is present in the teaching and learning. During this study, 58 articles are reviewed to determine if they meet the needed criteria. Lee et al (2013) stated that the three criteria are there is a “focus on teaching and learning with technology in K-12 classrooms,” each group is given a pre and posttest, and each “have reported statistical data that allowed calculations of effect sizes” (p. 135). The conclusion from this study showed that there was an increase in using technology to teach and learn during practices of instruction.

**Methodology**

**Overview of Research Design**

This research study will be a quantitative research design and lasted for nine weeks. The participants were from two co-taught math classes of the same teacher and were previously enrolled in a math skills class that uses Classworks. The participants’ CRCT scores from the fifth and sixth grade were compared to the other co-taught students not in math skills to determine which group performed better on the standardized test.

**Participants**

For this research project, the participants consisted of my current seventh-grade co-taught math students who had math support during connections in the sixth grade. The participants are a mixture of 20-25 males and females. The students are from various ethnic backgrounds and many students are from low socioeconomic status. From the participants, several students in their academic classes received services through special education. The number of students that participated in the study was 24. For the study, there were 8 males (33%) and 16 females (67%). The participants were from three ethnic backgrounds: Whites 10 (42%), Blacks 7 (29%), and Hispanics 7 (29%).

**Data Sources/Instrumentation/Procedures**

The project lasted for nine weeks. During this nine week period, the data of the participants was gathered from the students’ permanent records. The scores were compared to other co-taught students who are not in math support classes. Participates also shared their opinions about the Classworks program through an anonymous survey. The survey asked a series of questions about the effectiveness of the program. The survey contained four questions and the participants stated whether they strongly disagree, disagree, agree, or strongly agree.

**Analysis**

The quantitative data was analyzed through the statistical comparison of how the participants performed on the CRCT in the fifth and sixth grade with the aid of the Classworks program. For the data, the descriptive statistics was used to analyze the measures of central tendencies of participates’ scores in the Classworks program and other co-taught math students. An independent samples t-test was used to compare the changes in the participants’ scores in math during the fifth and sixth grade. The t-test was preformed twice for the group of participants who took or did not take math skills. The participants who took a math skills class during sixth grade were asked to complete a four-question survey.

**Limitations**

The major limitation during this study was the limited number of participants. Since the participants were from two co-taught classes of the same teacher, there was a limited amount of students who took math skills the previous year. Another limitation is the use of CRCT scores of some participants who took the modified version of the test. The modified scores had to be converted to a scale of 800 to ensure a true mean of the scores for both years.

**Results**

**Data Analysis of the CRCT scores**

**Table 1.** Comparison of CRCT Scores for 5th and 6th Grade for Students with Math Skills

|  |  |  |
| --- | --- | --- |
| t-Test: Paired Two Sample for Means |  |  |
|  |  |  |
|  | *Student's Scores (5th Grade)* | *Students Scores with Math Skills (6th Grade)* |
| Mean | 790.25 | 793.9166667 |
| Variance | 394.9318182 | 160.2651515 |
| Observations | 12 | 12 |
| Pearson Correlation | 0.68484645 |  |
| Hypothesized Mean Difference | 0 |  |
| df | 11 |  |
| t Stat | -0.875238919 |  |
| P(T<=t) one-tail | 0.200075779 |  |
| t Critical one-tail | 1.795884819 |  |
| P(T<=t) two-tail | 0.400151559 |  |
| t Critical two-tail | 2.20098516 |  |
|  |  |  |

The scores from 5th grade to 6th grade of students who were enrolled in Math Skills in the 6th grade were compared first. The mean of the students’ scores from 5th grade was 790.2; while the mean of the students’ scores from 6th grade was 793.9. The difference in means was significant at the p>.05 level (t=-0.8, df= 11).

**Table 2.** Comparison of CRCT Scores for 5th and 6th Grade for Students without Math Skills

|  |  |  |
| --- | --- | --- |
| t-Test: Paired Two Sample for Means |  |  |
|  |  |  |
|  | *Students' Scores (5th Grade)* | *Students' Scores without Math Skills (6th Grade)* |
| Mean | 816.0833333 | 800.6666667 |
| Variance | 151.9015152 | 17.51515152 |
| Observations | 12 | 12 |
| Pearson Correlation | -0.230294796 |  |
| Hypothesized Mean Difference | 0 |  |
| df | 11 |  |
| t Stat | 3.842434708 |  |
| P(T<=t) one-tail | 0.001367499 |  |
| t Critical one-tail | 1.795884819 |  |
| P(T<=t) two-tail | 0.002734999 |  |
| t Critical two-tail | 2.20098516 |  |

The scores from 5th grade to 6th grade of students who were not enrolled in Math Skills in the 6th grade were compared first. The mean of the students’ scores from 5th grade was 816; while the mean of the students’ scores from 6th grade was 800.6. The difference in means was not significant at the p<.05 level (t=3.8, df= 11).

**Data Analysis of Survey Results**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Strongly Disagree | Disagree | Agree | Strongly Agree |
| 1. The Classworks program helps me in my math class. | 0% | 17% | 58% | 25% |
| 1. The Classworks program is going to help me prepare for the math CRCT. | 8% | 17% | 67% | 8% |
| 1. The Classworks program helps me understand concepts I struggle with. | 17% | 33% | 42% | 8% |
| 1. I believe I can excel using the Classworks program. | 8% | 42% | 42% | 8% |

**Discussion**

In addressing whether or not using Classworks in math skills increases the students’ CRCT scores from one grade to the next, the data from the quantitative analysis showed that there was an increase of scores from the 5th grade to the 6th grade for students who were enrolled in Math skills. In comparing the averages of the scores from 5th to 6th grade, the students enrolled in math skills in the 6th grades had an increase of 3.7 points on the CRCT, while the students not enrolled in math skills had a decrease of 15.4 points on the CRCT. Overall, the evidence shows that the Classwork program in math skills increases the students’ scores on the CRCT.

**Survey Results**

The survey was only completed by participants who were enrolled in math skills during the sixth grade. The majority of the students agreed that the Classworks program used in math skills helped also in their math class. The majority of the students also agreed that the Classworks program used in math skills helped prepare them for the information tested in the math CRCT. For the final two questions in the survey, the percentages were split between whether the students agreed or disagreed with the questions. There was an even split for if the students thought the Classworks program used in math skills helped them understand concepts that they struggled with. The final question also had an even split when asked if the Classworks program helped the students excel in the math classroom. Overall, it seems that many students believe the program used in math skills helps and others believe the program does not benefit their learning.

**References**

Classworks Curriculum Advantage (2013). About curriculum advantage. Retrieved November 19, 2013 from <http://www.classworks.com/index.cfm/connect/about-curriculum-advantage/>

Computer-aided instruction. (n.d.). *The Free On-line Dictionary of Computing*. Retrieved December 02, 2013, from Dictionary.com website:[http://dictionary.reference.com/browse/computer-aided instruction](http://dictionary.reference.com/browse/computer-aided%20instruction)

Curry School of Education (2012). Co-teaching defined. Retrieved November 28, 2013 from <http://faculty.virginia.edu/coteaching/definition.html>

Frye, N & Dornisch, M. ( 2008). Teacher technology use and student evaluations: the moderating role of content area. *J. Educational Technology Systems*, 36 (3), 305-317.

Georgia Department of Education (2013). Criterion referenced competency test (CRCT). Retrieved on October 20, 2013from <http://www.gadoe.org/Curriculum-Instruction-and-Assessment/Assessment/Pages/CRCT.aspx>

Huang, T., Liu, Y., & Chang, H. (2012). Learning achievement in solving word-based mathematical questions through a computer-assisted learning system. *Educational Technology & Society*, 15(1), 248-259.

Lee, Y., Waxman, H., Wu, J., Michko, G., & Lin, G. (2013). Revisit the effect of teaching and learning with technology. *Educational Technology & Society*, 16(1), 133-146.

Leh, J & Jitendra, A. ( 2012). Effects of Computer-mediated versus teacher-mediated instruction on the mathematical word problem-solving performance of the third-grade students with mathematical difficulties. *Learning Disability Quarterly*, 36 (2), 68-79.

Meletiou-Mavrotheris, M. & Mavrotheris, E. (2012). Game-enhanced mathematics learning for pre-service primary school teachers. *In the Proceedings of the ICICTE*, 455-465.

Periathiruvadi, S. & Rinn, A. (2012). Technology in gifted education: a review of best practices and empirical research. *Journal of Research on Technology in Education*, 45 (2), 153-169.

Rasanen, P., Salminen, J., Wilson, A., Aunio, P., & Dehaene, S. (2009). Computer-assisted invention for children with low numeracy skills. *Cognitive Development*, 24, 450-472.

Slavin, R. & Lake, C. (2007). Effective programs in Elementary mathematics: a best-evidence synthesis. *Best Evidence Encyclopedia*, 1.2, 1-40.

Taj, H & Sivalingam, P. (2013). Effect of computer assisted instruction and traditional instruction method on teaching mathematics. *Indian Streams Research Journal*, 3 (4), 1-4.

Tienken, C. & Maher, J. (2008). The influence of computer-assisted instruction on eighth-grade mathematics achievement. *Research in Middle Level Education Online*, 32(3), 1-13.

**APPENDIX A**

Student Survey (Anonymous)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Strongly Disagree | Disagree | Agree | Strongly Agree |
| 1. The Classworks program helps me in my math class. |  |  |  |  |
| 1. The Classworks program is going to help me prepare for the math CRCT. |  |  |  |  |
| 1. The Classworks program helps me understand concepts I struggle with. |  |  |  |  |
| 1. I believe I can excel using the Classworks program. |  |  |  |  |