Does Media in the Classroom Increase Elementary School Students' Math Achievement?

Southern Illinois University Edwardsville

Lynette Johnson

Submitted in Partial Fulfillment of the Requirements for
EPFR 501 – Section 701

July 9, 2012

Table of Contents

Abstract

This study is designed to compare the effects of multimedia in the classroom vs. no multimedia in the elementary classroom on student math achievement. In this study, a convenience sampling and a quasi-experimental design, the nonequivalent control group design is used. The study will be divided between two schools and three groups within each school. The experimental group is a media-rich school that uses a plethora of media in the classroom. The control group does not utilize media in the classroom; rather it focuses on traditional instructional methods. Participants in both groups will include students from grades 3-7. Students will receive the same instruction in preparing them for the 2013 Illinois Standards Achievement Test – Math (ISAT-Math). It is hypothesized that there will not be a significant difference in math scores for the 2013 ISAT Math tests between the experimental group and the control group.

Keywords: multimedia, math achievement, convenience sampling, quasi-experimental design

Introduction

Background and Significance

American schools have suffered many declines over the years in math despite billions of dollars that are spent putting multimedia in schools each year. According to the site, http://www.whitehouse.gov/issues/education/educate-innovate, American students recently ranked 25th out of 30 in math literacy compared to other countries.

Many schools today have incorporated the use of media for classroom instruction. Media includes text, audio, graphics, animation, video, games etc. The use of media in the classroom is not a new concept and schools spend millions of dollars upgrading to the latest and greatest form of media. According to a 2011 report from the White House Council on Economic Advisors, "Educational Technology holds the promise of substantially improving outcomes for k-12 students." (Executive Office of the President Council of Economic Advisors, 2011). This same report states that currently, the U.S. spends about $2.9 billion on k-12 e-Learning, while globally, $9.4 billion is spent on k-12 e-Learning. Also, in this report, as of 2005, 93% of schools have instructional rooms with Internet access. With so much money being spent on providing classrooms with multimedia, it will be of interest to see if the results reciprocate the efforts.

Problem Statement

The purpose of this study is to investigate whether classroom media increases math achievement in elementary school students. The intention is to gather data such as math test scores in classrooms that are media rich and classrooms that do not have media.

Literature Review

There are many debates as to whether media increases learning. School districts believe that media does increase learning and as a result have invested in Internet access for classrooms, mobile devices, computers, interactive whiteboards, online games and more to support the use of educational technology. The U.S. Department of Education also provides grants to states to enhance educational programs. In 2009, congress distributed $650 million in educational technology (SETDA, 2010).

In a study done by Li and Ma (2010), they examined the impact of multimedia in the classroom on mathematics achievement. Their findings were that multimedia does not have a significant impact on math achievement. Also, in their findings, they discovered that math interventions of shorter durations (such as 6 months or less) were more effective than math interventions of longer durations (over 6 months). Li and Ma did find that multimedia can have a significant impact on student math achievement in the following instances: 1) When used for students with an IEP, 2) when used in the elementary math class, and 3) when the teaching approach is constructivist. Li and Ma did a review of 48 studies of elementary students and discovered that lower achievers and special needs students benefit most from multimedia instruction for math.

Li and Ma also found that different types of media did not produce different results, meaning that students that are taught the same instruction using different forms of media produced the same results. Lastly, Li and Ma noted that when new media is introduced, student achievement may soar, but as students get familiar with a form of media, the effects may subside as motivation to use the media for learning is decreased.

Other recent studies also agree that multimedia in the classroom produce small effects on math achievement. In a study done by Slavin et al. (2009), they included 38 multimedia studies in an elementary school review. In this study, Slavin et al. had a length of 12 weeks, equality between the treatment and control group, and both groups had at least two teachers. In their study, they found that multimedia produced only a +0.19 increase in math achievement.

In a study done by Rakes et al. (2010), they examined the effectiveness of instructional advancement strategies for algebra in 5 different categories. This study used 82 studies and included in them were 15 technology-based instructions, and 21 multimedia tools. The study determined that the strategies yielded a +0.16, and the multimedia curriculum and instruction tools were +0.15 and +0.17.

In looking further into the phenomena of incorporating multimedia into the classroom, this proposal examines the professional opinions of leaders in the educational field. One such leader is Robert Kozma, emeritus director and principal scientist at SRI International. Kozma stated that it is possible for technology to make a noteworthy contribution to student achievement, but that it is not technology alone that helps students learn (The Economist, 2007). Kozma argued that the use of media must be aligned with teacher training to consolidate media into their lessons, "with applications that draw on

the unique capabilities of technology, and with supportive curricular, assessment, and school contexts that advance complex problem solving, creative thinking, and life-long learning—skills." Kozma further believes that it is not the media, but rather the instructional methods that increase student learning. In this debate, Kozma also believes that teachers should think in a methodical way regarding the use of media in instruction. It is not enough to simply introduce media into the classroom, rather teachers should first be trained on incorporating the media and media should be aligned with curriculum, so that it's not just a matter of using media for the sake of using it. Also, Kozma believes that teachers should learn and make use of all aspects of the media so that both teachers and students benefit from media usage.

Another perspective is viewed from Richard Mayer (Learning and Instruction, 2003). Mayer believes that that lack of media or "verbal-only instruction" is not effective for learners. Mayer believes the goal of using multi-media in the classroom is to stimulate meaningful learning. His goal in this article was to study if using the same instructional method would work across different media. Just as Li and Ma, Mayer found that instructional design methods do work across different media, providing deep learning. Mayer suggests that instruction should be based on the comprehension of the nature of how humans learn, instead of focusing on different technologies. He says that incorporating different technologies does not change how humans learn. However, if the media instruction is designed intuitively, it can be a formidable support for student achievement.

Rationale of the Study

A review of the above studies show that media does not have a major, long-term impact on mathematics achievement. Some of the studies further posed more questions namely: Even if students do receive higher scores on standardized tests, does that mean that greater levels of learning has been achieved? Based on the above literature review, the major research hypothesis in this study was:

Statement of Hypothesis

Based on the literature review, it is hypothesized that there will be a minor significant difference (null hypothesis) in math achievement as measured on the 2013 ISAT tests between the media rich school and the non-media rich school.

Method

Participants

Participants for this study will be elementary school students from two different schools in Chicago. One of the schools uses CCC! Streaming Media, which provides a variety of multimedia resources for the classroom to include subjects such as math. The multimedia for this school includes video, audio, maps, data, graphics, animation and Flash-based media from Disney Educational Production, National Geographic Education, and the BBC. The other school offers a hands-on science lab, two computer labs, and after school help in math, reading and writing. The media-rich school is 65.2% black, 2.7% white, 30.1% Hispanic, 0.1% Asian, 1.9% mixed race, and has a 92.2% low income rate with 16.7% students reported as having an IEP. The traditional school is 99.4%

black, 0.2% white, 0.2% Hispanic, 0.2% mixed race, and has listed 10.9% of students as having an IEP with 98.8% categorized as low income. I chose the first school because I was searching for a school that had a media-rich curriculum. I chose the second school because that is the school that I attended as a child, and the test scores on the Illinois Report Card are currently about equal for both schools. I will be using Stratified Sampling for equal sized groups. I will first divide the students into groups depending on grade. I will then break those groups up into subgroups of high, average, and low-ability. Next, I will randomly choose ten (10) students from grades 3-7. Three (3) will be high achievers, four (4) will be average, and three (3) will be low achievers all in math.

Instrument

The Illinois Standards Achievement Test (ISAT) Math Assessment will be used as the measuring instrument as well as the Illinois State Report Card.

The ISAT measures math achievement for grades three through eight (3-8) yearly. The Illinois Learning Standards is the primary support used to prepare students for the ISAT. The Illinois State Board of Education uses four performance level designations of mathematics. These designations are used to determine how student test results are classified in the four performance levels. Session 1 of the test includes 40 multiple-choice items. Session 2 includes 30 multiple choice and 3 short-response items. Session 3 is comprised of 2 extended-response items. The content of the test is taken from the Illinois Mathematics Assessment Framework and includes concepts such as: number sense, measurements, algebra, geometry, data analysis, statistics and probability. The sessions are 45 minutes each. Paper rulers are allowed for all grades. A reference sheet

is allowed for grades 7-8, and calculators are allowed for grades 4-8.

ISAT is administered uniformly across the state of Illinois. Teachers supervise students during testing and are not allowed to help students with any part of the test. Only students that have an IEP or 504 Plan are allowed to have teachers/instructors read to them during assessments.

The short and extended response items are scored using a rubric. All math-scoring rubrics are found at this site: http://www.isbe.net/assessment/math.htm. The Extended Response scoring is dividing according to mathematical knowledge, strategic knowledge, and explanations. Score levels are rated from 4 (highest) to 0 (no answer attempted). The Short Response Items are rated from 2 (highest) to 0 (no response, or totally incorrect). The Principal Mathematics consultant for the 2012 ISAT Math Assessment was Rachel Jachino (2011).

The ISAT is an appropriate instrument for my research plan because all students in Illinois are required to take this test. Because tests are administered uniformly, neither school in my research plan should have an unfair advantage with regard to more time to study for the test. John W. Wick (2001) did an independent investigation study to compare the ISAT tests to the Stanford Achievement Test (SAT), and he found that the validity and reliability of ISAT met or exceeded that of the SAT.

Table 1 below from the State Board of Education – Division of Assessment shows the reliability for the 2010 ISAT. According to Gay et al., (2012), high reliability has a coefficient close to 1.00, which indicates that the measurement of errors is very small. As you see in the table, the math reliability estimates were all .93 or higher, so we can be assured that the ISAT test is a highly reliable test.

Reliability Estimates (Based on population data)

Table1

Grade	Math
3	.94
4	.93
5	.94
6	.94

Research Design

There will be a group of one hundred (100) students, with (50) fifty students from each school. Students will take the ISAT in March 2013. This quantitative plan seeks to determine if there is a causal relation between use of media in the classroom and math achievement. This plan will apply the nonequivalent control group design. As stated earlier, I will break the groups of ten students in each grade from third through seventh into subgroups based on sets of three high achievers, four average, and three low achievers. I will compare the three groups in each grade against those same three groups in the other school to reduce the possibility of validity threats. The research design is illustrated in Table 2 below.

Experimental Design

Table 2

Groups	Assignment	Number of Participants	Pretest	Treatment	Posttest
High achievers	Nonequivalent control	30 – (15/school) 6 each from grades 3-7	ISAT Pretest	15 – media instruction 15- no media instruction	ISAT (Illinois Standards Achievement Test – Math)
Average achievers	Nonequivalent control	40 (20/school) 8 each from grades 3-7	ISAT Pretest	20 – media instruction 20- no media instruction	ISAT-Math
Low achievers	Nonequivalent control	30 – (15/school) 6 each from grades 3-7	ISAT Pretest	15 – media instruction 15- no media instruction	ISAT-Math

Procedure

At the beginning of the school year, 100 elementary students from two schools will be randomly selected from a population of approximately 1000 students. During the school year, the first school as stated above will be taught math using the CCC! Multimedia. The second school will be taught using traditional lecture, discussion, and hands-on methods. Academic objectives and all tests measuring achievement will be the same. Throughout the year, students will receive ISAT pretests. In March, the ISAT test (posttest) will be administered to both schools at the same time.

Data Analysis Plan

After the completion of the Illinois State Achievement Test, scores will be reviewed. The scores of the two groups will be compared and a comparison will be made to determine whether or not multimedia has the greatest effect on student math achievement. ISAT test scores will be coded and analyzed using MS Excel 2010. Results of the ISAT will be analyzed using the Paired-Samples T Test. The pairs will be high achievers, average achievers, and low achievers from both schools. If the calculated scores or α is less than or equal to .05, then the research hypothesis will be rejected. Otherwise, the research hypothesis will be supported.

Time Schedule

The time schedule for the project is illustrated in Table 3 below.

Table 3

Time Schedule

	August 2012	**September …February**	**March 2013**	**June…July 2013**	**August 2013**
Meet with Administrators	X				
ISAT preparation	X	X	X		
ISAT test			X		
Analyze Data				X	
Write Report					X

The timetable of the study ranges from August 2012 to July 2013. At the start of the school year in August 2012, students will be randomly chosen and permission slips will be sent out. After the ISAT test is complete, data will be analyzed as soon as it is available, and will take place through July 2013. Upon finalization of data, the report will be completed in August 2013.

References

Chico, J. (2011). Illinois Standards Achievement Test. Illinois State Board of Education. Retrieved June 27, 2012, from http://www.isbe.net/assessment/isat.htm

Deubel, P. (2007). The Great Debate: Effectiveness of Technology in Education [Online]. *The Journal – Transforming Education Through Technology*. Available: http://thejournal.com/Articles/2007/11/08/The-Great-Debate-Effectiveness-of-Technology-in-Education.aspx?Page=1

Executive Office of the President Council of Economic Advisors. (2011). [Online]. *Unleashing the Potential of Educational Technology.* Available: http://www.whitehouse.gov/sites/default/files/unleashing_the_potential_of_educational_technology.pdf

Gay, L.R., Mills, G.E., Airasian, P., (2012). *Educational Research Competencies for Analysis and Applications*. 10th ed. NJ: Pearson.

Jachino, R. (2011). 2012 ISAT Math Assessment. In Illinois State Board of Education Division of Student Assessment. Retrieved June 27, 2012, from http://isbe.net/assessment/pdfs/2012/isat/ISAT_math.pdf, http://www.isbe.net/assessment/pdfs/isat_tech_2010.pdf

Kozma, R. (2003). Innovative practices from around the world: Integrating technology into the classroom. *Leading and Learning*, 21(9), 6-9, 52-54.

Kozma, R. (2007). Technology in education: A debate between Sir John Daniel and Robert Kozma. *Economist.com.*

Li, Q., & Ma, X. (2010). A meta-analysis of the effects of computer technology on school students' mathematics learning. *Educational Psychology Review,* 22, 215-243.

Mayer, R. (2003). The promise of multimedia learning: using the same Instructional design methods across media. *Learning and Instruction*, 125-139.

Northern Illinois University. (2011). Illinois Interactive Report Card. In Illinois Standards Achievement Test. Retrieved June 27, 2012, from http://iirc.niu.edu/Tests.aspx?isat

SETDA. (2010). National educational technology trends: 2010. Retrieved July 10, 2012: www.setda.org

Slavin, R. E., & Lake, C., & Groff, C. (2009). Effective programs in middle and high school mathematics: A best evidence synthesis. *Review of Educational Research.*79(2), 839-911.