# The Effects of Instructional Technology on Academic Achievement in Elementary Public Schools: A True Experimental Research Study

Marilin Equihua

California State University, Long Beach

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## Abstract

This experimental study will examine the influence of instructional technology on academic achievement scores among third graders in an elementary public school by comparing standardized test scores in the areas of English language arts and mathematics of an experimental and control group. Three third grade classrooms will implement various instructional technological tools in the classrooms, with an emphasis on the web-based resource *EdCite*. This online resource allows users to create assessments similar to the Smarter Balanced Assessment Consortium (SBAC) in various subject areas. The other 3 classrooms will continue with traditional instruction. The teachers in the treatment classrooms will incorporate *Edcite* and other instructional technological tools of their choosing in their English language arts and mathematics lessons at least 3 times a week, while the control group will use only what is provided by the school district. The teachers incorporating instructional technology will receive additional training in the form of Professional Development at their school site throughout the year. Students in both groups will take the SBAC at the end of the school year as a performance measure. Results should show a significant difference between standardized scores in favor of students receiving instructional technology in their classrooms in English language arts and mathematics.


*Keywords*: instructional technology, elementary public schools, academic achievement

# The Effects of Instructional Technology on Academic Achievement in Elementary Public Schools

## Introduction

### Review of the Literature

Instructional technology has become an essential part of 21st century learning. Unfortunately, many elementary school teachers do not use instructional technology in their classrooms because teachers are not aware of its benefits. Barron, Kemker, Harmes, & Kalaydjian (2003) found that only 29% of elementary teachers integrate computers in their classrooms as a tool for problem solving and only 32% of elementary school teachers use computers as research tools.

This may be due to the many barriers that teachers face when trying to implement technology. Ertmer, Addison, Lane & Woods (1999) conducted a study in which they examined the relationship between external and internal barriers to the implementation of technology. Some of these barriers include lack of technology access, lack of planning time, inadequate support from administrators, as well as their own personal beliefs about technology and classroom practices.

Research has shown that in order to have successful implementation of technology by teachers, many things have to be set in place. Hew & Brush (2007), for example, recommend that administrators should have a technology plan in place which addresses the relationship between technology and the content areas and which communicates to teachers how technology can be used. They also suggest that Professional Development should be provided that focuses on content and provides opportunities for hands-on work using the technological tools that they

are expected to use in the classroom. In order to lessen the barriers, Christensen (2002) conducted a study in which 60 elementary school teachers received instruction and Professional Development in the integration of computers in the classroom. The study found that 95% of the teachers who received the instruction increased their use of technology in the classroom compared to 59% of those teachers who did not integrate technology.

Past research has also demonstrated the positive effects of instructional technology in elementary education. Kulik (2003), for example, reviewed a variety of studies on the effects of Integrated Learning Systems (ILS) that demonstrated that students receiving ILS instruction scored higher on standardized tests than those students who did not. One of the studies, for example, conducted by Clariana (1996) found that students receiving math instruction using ILS scored consistently higher on concept and application tests than those who did not receive ILS instruction (as cited in Kulik, 2003). Other programs that Kulik (2003) found to be effective include Writing to Read (WTR) and Accelerated Reader (AR). In a study conducted with kindergarten and first grade students on the effects of WTR, all three kindergarten groups that received instruction using the program showed gains in reading achievement. The study on the effectiveness of AR found that "…the scores of the AR group increased 18 points each year from the third to the sixth grade, whereas the control group gained 10.3 points" (Kulik, 2003, p. 48).

Furthermore, another study conducted by Serin (2011) found that a computer-based science program also had a positive effect on student success in a science and technology course. Serin's (2011) study found that the program used with the experimental group had a positive effect on the problem solving skills in the science and technology course with a 31.8% variance. Reeves (1998) also found evidence of technology impact in the subject of History. He found that when students used technology to do a project about the Civil War "…they developed

generalizable skills such as taking notes, finding information, coordinating their work with other team members, writing interpretations, and designing presentations" (p. 30-31).

A related research study that has been mentioned in research studies throughout the years is the Apple Classrooms of Tomorrow (ACOT). In the classrooms that utilized ACOT, "…students used technology as a tool to collect, organize, and analyze data; to enhance presentations; to conduct simulations and to solve complex problems" (as cited in Muir-Herzig, 2003, p. 4). The ten year study found that technology encourages a variety of interactions between teachers and students and that it engages students in higher order thinking (as cited in Barron et al.).

Similarly Butzin (2001) produced similar results wherein he compared classrooms which implemented the program Project CHILD (Computers Helping Instruction and Learning Development) to those that did not. This study compared standardized test scores in reading and math for students at 2 schools in Florida. One school implemented Project CHILD and the other school did not. The results found that the third year students receiving instruction using Project CHILD scored higher on all tests compared to those students in the control group that did not receive the treatment.

According to Lowther, Ross, & Morrison (2003), students who participated in laptop classes scored higher on writing achievement tests and problem solving achievement tests than students who did not have one to one laptops. Furthermore, Mouza (2008) stated that "…laptop integration created enhanced motivation and engagement with schoolwork, influenced classroom interactions, and empowered students."

In summary, these studies have demonstrated that instructional technology tends to have a positive effect on students across content areas. Although certain barriers exist that prevent teachers from utilizing technology in their classrooms, administrators can lessen the barriers by providing quality training and professional development opportunities that will enable teachers to integrate technology in effective and efficient ways. By providing students with quality technology integration, they will be more likely to be engaged in lessons, committed to learning, and increase their academic achievement.

**Problem and Statement of Purpose**

Although past studies show the effectiveness of technology integration in educational performance and achievement scores, additional research is necessary in order to determine the effectiveness of new technologies that continue to emerge within educational settings. It is also important that a quantitative study be conducted to determine the effects of instructional technology on academic achievement scores in elementary public schools so that teachers can weigh the benefits over the barriers. The purpose of this study is to examine the effects of the application of the instructional technology *EdCite* in the classroom on students' academic achievement scores for third grade students in California public schools on the SBAC. The research question that will be addressed in this true experimental study is:

> *What effect does instructional technology have on students' standardized achievement scores in the areas of language arts and mathematics?*

The alternative hypothesis ($H^1$) is that the use of the instructional technology tool *EdCite* in public elementary schools is positively related to academic achievement scores on the SBAC among third grade students in Paramount Unified School District (PUSD). The potential benefits

of such investigation can provide a more in depth understanding of the effects of instructional technology in elementary public schools, and administrators and teachers can move forward with implementation of instructional technology in their classrooms.

## Method

### Participants

Participants for this study will be 150 incoming third grade students at Major Lynn Mokler Elementary School in the Paramount Unified School District in Paramount, California. The public school consists of approximately 720 students in Transitional Kindergarten through 5th grade. According to current School Accountability Report Card, 88% percent of students in the school are Hispanic or Latino and 94% are socioeconomically disadvantaged students and receive free or reduced lunch (California Department of Education, 2015).

### Instruments

To compare results from the experimental and control groups, performance measures will be used. At the end of the school year, all third grade students participating in the study will be administered the Smarter Balanced Assessment Consortium (SBAC), which is a computer adaptive summative assessment that measures students' academic abilities. The assessment is computer adaptive which means that it is tailored to each student's ability because it automatically generates questions based on student responses. If, for example, a student responds correctly to an assessment question, the following question will be more difficult. But if the student responds incorrectly to the question, the next question will be easier. This type of assessment may provide an accurate and reliable way to evaluate student achievement.

Results on the SBAC from the respective sample population will be collected and analyzed to compare the percentile scores between the two groups. Scores will be calculated and placed into four categories: "standard not met," "standard nearly met," "standard met," and "standard exceeded" using the corresponding percentile rank for each category. This study will look at overall profile scores on the SBAC of the participants in English language arts and mathematics.

**Procedure**

Students for this study will be randomly placed in 6 third grade classrooms by the administration at the school site prior to the first day of instruction. The sample population will be controlled for gender, academic abilities (based on 2nd grade report cards), and English learner level (California English Language Development Test placement). The experimental and control groups will also be randomly selected. The sample student population will be aggregated into an experimental and a control group. Additionally, three teachers will be randomly placed in the experimental group and the other three in the control group.

The teachers that will make up part of the experimental group will receive additional professional development and training opportunities with instructional technology, specifically the web-based resource *Edcite*, and will implement instructional technology in their classrooms. *EdCite* is an online free website that allows users to create assessments similar to those found on SBAC. The teachers in the control group will use traditional teaching methods and will not receive additional technological support. The teachers will teach the sample participants from the beginning of the school year until the end of the school year.

Internal Review Board (IRB) applications were submitted to California State University, Long Beach and human research studies. Permission from the district personnel and administrator will be sought. Once permission is given by administration, teachers will be informed of the study and their written permission will be obtained. Finally, parents of students will be contacted through phone calls, emails, and school flyer and will be invited to participate in an informational meeting to inform parents and students about the study and the information that would be collected from them. They will also be informed that participation is voluntary and they can withdraw their participation at any time during the study. Parents and students will sign a consent form at the end of the meeting with their decision and all other IRB requirements will be met prior to implementation of the study (Appendix).

Once permissions are obtained, the three teachers that will be randomly selected to be part of the experimental group will receive three-day training on the uses of the instructional technology in the classroom one week prior to the beginning of the school year. During the training, teachers will receive training on the instructional technological tool *EdCite*. They will learn how to use the tool, how to incorporate it within their curriculum, will be provided with sample lessons utilizing the tool, and will have time to work collaboratively to create lesson plans that incorporate the tool.

Once the school year begins, the teachers in the experimental group will be provided with laptops three days a week for every student in their class. Due to limited access, the laptops will only be available to the experimental classrooms three times a week. The control group only will only have access to one to one desktop computers when they go to the computer lab for two hours every week.

The teachers in the experimental classrooms will also meet with each other once a month throughout the school year to discuss best practices and plan upcoming lessons with the instructional technological tool *EdCite*. The technology lead teacher at the school site, which provides technological support to students and staff, will also meet with them during that time to provide further training and professional development opportunities. By the end of the school year, the teachers in the experimental group will have knowledge about a variety of instructional technological tools that they can apply in their classrooms through the various professional development opportunities.

**Data Analysis**

At the end of the school year, all third grade classes will administer the SBAC assessment to students. The test will be administered over 4 sessions, 2 sessions for English language arts and 2 sessions for mathematics. For the purposes of this study, only 2 sessions will be analyzed, the computer adaptive part of the SBAC, one in English language arts and one in mathematics. The assessment procedures will be standardized to ensure validity. Every class will complete each session in the computer lab over a week's time. Each session will be scheduled for one hour and a half, but is untimed and can take longer if necessary.

The assessments will be scored using a numeric point value scale. Depending on the number of parts included in each question, the questions can be worth between 1-3 points each. Once scores have been calculated for all questions on the assessments, summed scores will be collected for the whole assessment. There will be two summed scores collected, one for English language arts and one for mathematics. Then descriptive statistics will be used to compare the experimental groups' scores with the control groups' scores. A *t-test* will be used to test for the

degree of difference between scores across English language arts and mathematics on the SBAC of the experimental and control groups.

## Results

The results of this study should answer the research question stated at the beginning of this study. The research question asked: *What effect does instructional technology have on students' standardized achievement scores in the areas of language arts and mathematics?* Based on past studies, there should be a significant positive effect on standardized achievement SBAC scores in the areas of English language arts and mathematics. SBAC scores of the participants in the experimental group should be significantly higher in comparison to the control group. The studies mentioned in the literature demonstrated positive effects on students, so this study should not be any different, especially because this study will try to bring down some of the barriers presented in previous studies, such as providing teachers with training and professional development.

After conducting the study, a table will be used to demonstrate the comparisons between the experimental and control groups. One table will present information on English language arts profile scores for the two groups and the other will present information about the mathematics profile scores.

## Discussion

### Implications

It is anticipated as demonstrated in related literature that instructional technology has a positive effect on students in many different ways. However, instructional technology must be taught effectively and efficiently. Therefore, teachers must receive training before the

implementation of any educational technological tool. Lei & Zhao (2005) suggest that in order for technology to increase student's GPA, teachers must use specific subject-related technology and use technology in a way that focuses on "student construction" (p.9). This study will try to close that gap by providing teachers with training and professional development prior to the beginning of the study and throughout the study.

This research study can provide significant contributions to the field of educational technology. First of all, since there are new technological tools emerging constantly research needs to stay current with the use of the new instructional technologies that exists. This study aims to incorporate new instructional technological tools such as *EdCite* that have emerged recently. Second, this study can provide additional research as to the positive effects of instructional technology in elementary classrooms and encourage teachers to use instructional technology more frequently in their lessons.

**Limitations**

Although this study is closing the gap in some areas, there are also limitations. One possible limitation of this study is that the participants are only a small sample of third grade students. Future research should focus their studies across grade levels in order to get more accurate results. Another limitation of this study is that this is only focusing on one school in one setting. In order to receive more valid results, a study should be conducted that includes a larger sample of schools with a more diverse population. In addition, this study focused on only one instructional technological tool, EdCite. Results for the use of EdCite in the classroom may not provide the same results as the use of other technological tools.

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# Appendix

## CONSENT TO PARTICIPATE IN RESEARCH

The Effects of Instructional Technology on Academic Achievement in Elementary Public Schools

You are asked to participate in a research study conducted by Marilin Equihua, Graduate Student, from the College of Education at California State University, Long Beach. You were selected as a possible participant in this study because you will be a third grade student at Major Lynn Mokler in Paramount, California during the 2016-2017 academic school year.

### PURPOSE OF THE STUDY

The purpose of this study is to examine the effects of the application of the instructional technology *EdCite* in the classroom on students' academic achievement scores for third grade students in California public schools on the Smarter Balanced Assessment Consortium, or SBAC.

### PROCEDURES

If you volunteer to participate in this study, you will do the following things:

Your child will be randomly placed in a third grade classroom. If placed in an experimental group, the teacher will implement the use of the instructional technology tool *EdCite* and other instructional technology tools at least three times a week in addition to the resources provided by the Paramount Unified School District (PUSD). If placed in the control group, the teacher will only use the resources provided by the PUSD.

The study will take place during the 2016-2017 academic school year, which is the length of participation in the study. At the end of the study, their scores in English language arts and mathematics on the SBAC assessment will be collected and analyzed.

### POTENTIAL RISKS AND DISCOMFORTS

This research study does not have any foreseeable risks, discomforts, or inconveniences for students. There are not any physical, psychological, or social risks that may affect your child in any way since the research will only take place during the school day.

### POTENTIAL BENEFITS TO SUBJECTS AND/OR TO SOCIETY

If a student is placed in the experimental group, the potential benefit is that the use of instructional technology may benefit them academically and help them achieve higher scores on the SBAC. There are no potential benefits for students placed in the control group.

The results of this research study may provide significant contributions to the field of educational technology by providing additional research to the positive effects of instructional technology use in the classroom. The potential benefits may include higher academic achievement on standardized achievement assessments, such as SBAC.

PAYMENT FOR PARTICIPATION
There will be no payment awarded to parents or student participants.

CONFIDENTIALITY
Any information that is obtained in connection with this study and that can be identified with you will remain confidential and will be disclosed only with your permission or as required by law.
PARTICIPATION AND WITHDRAWAL
You can choose whether to be in this study or not. If you volunteer to be in this study, you may withdraw at any time without consequences of any kind. Participation or non-participation will not affect your child's academic schooling or any other personal consideration or right you usually expect. You may also refuse to answer any questions you don't want to answer and still remain in the study. The investigator may withdraw you from this research if circumstances arise in which the opinion of the researcher warrants doing so.

IDENTIFICATION OF INVESTIGATORS
If you have any questions or concerns about the research, please contact:
Marilin Equihua, Graduate Student at 562-123-4567

RIGHTS OF RESEARCH SUBJECTS
You may withdraw your consent at any time and discontinue participation without penalty. You are not waiving any legal claims, rights or remedies because of your participation in this research study. If you have questions regarding your rights as a research subject, contact the Office of University Research, CSU Long Beach, 1250 Bellflower Blvd., Long Beach, CA 90840; Telephone: (562) 985-5314. Email: ORSP-Compliance@csulb.edu

SIGNATURE OF RESEARCH SUBJECT (AND) OR LEGAL REPRESENTATIVE
I understand the procedures and conditions of my participation described above. My questions have been answered to my satisfaction, and I agree to participate in this study. I have been given a copy of this form.

_____
Name of Subject

_____
Name of Legal Representative (parent/guardian)

_____ _____
Signature of Subject or Legal Representative Date

STATEMENT and SIGNATURE OF INVESTIGATOR
In my judgment the subject is voluntarily and knowingly giving informed consent and possesses the legal capacity to give informed consent to participate in this research study.

_____ _____
Signature of Investigator Date