

The Impacts of Instruction Using Technology on the Math Achievement of Fourth Grade
Students

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Submitted in Partial Fulfillment of the Requirements for the
Degree of Master of Education

July 2013

Graduate Programs in Education

Goucher College

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Abstract

The purpose of this study was to determine whether the impact of instruction using technology influenced the math achievement of fourth grade students. The measurement tool was the Baltimore County Public Schools Grade 4 Unit 8 math assessment. This study involved the use of a pretest/posttest design to compare data from the beginning of the fractions unit (before the intervention was administered) to data from the end of the unit (after the intervention was nearly complete). Achievement gains were not significant, though results could be attributable to a number of intervening factors. Mathematics instruction should continue to provide various teaching strategies in order to meet the needs of all students

CHAPTER I

INTRODUCTION

Overview

Achievement is all about completing goals that one has set for him or herself and reaching these goals. Achievement means something different for everyone. Research states that the highly qualified and highly effective teachers are the key to students' academic success. There are claims that the teacher factor was the most significant school predictor of students' academic achievement, particularly in the area of mathematics (Konstantopoulos & Chung, 2011). It is important for students to excel in mathematics because the skills acquired are used on a daily basis. If students do not master those skills, they may not be able to excel in life.

This study was designed to explore teaching strategies designed to improve mathematics achievement. Inequalities in the availability of technology in schools have encouraged the researcher to consider the impact of technology on student achievement. The efficacy of many teachers is being, in part, determined on their ability to use and infuse technology in their lessons. The researcher went to school when there was no technology and feels she was successful and wonders if technology really increases students' achievement.

Technology is just one of the many strategies there are to help students excel in mathematics. There is research that supports the theory that the use of technology will improve achievement in the classroom, especially if the students are interacting with the technology and the technology relates to the content area. For students in today's society, technology holds great promise for creating a new learning environment that not only

engages them in contextually-based content, but also enables students to personalize their learning and empowers curiosity that is missing from a traditional classroom (Kiger, Herro, & Prunty, 2012). Students could also be tutored. Tutoring would allow students a one on one opportunity to work with a highly qualified teacher. There are also opportunities for students to tutor each other in class through a program entitled Classwide Peer Tutoring (Tsuei, 2012). Children's literature is also another method to reach students in the classroom. Teachers try to explain a concept and how it would apply to daily life but students struggle to connect. The National Council of Teachers of Mathematics promotes the collaboration between reading and mathematics (Young & Marroquin, 2006). Reading literature before a lesson preassesses understanding, introduces new vocabulary and topics, introduces manipulatives and connects with prior experience. Reading stories during a math lesson can reinforce vocabulary, address misconceptions, encourage higher level thinking, generate new knowledge and make connections among concepts. After a lesson, literature can be used to review skills, prompt further questions, make connections to real life scenarios, encourage connections with other topics and serve as an extension (Golden, 2012). All children enjoy playing games and it is through group games that children discuss with their peers and use mathematical language that is essential for developing reasoning skills and an understanding of the concepts. Games foster discussions among students that involve students using mathematical language when reasoning as well as develop an understanding of mathematics concepts. Games can contribute to teaching and learning by providing materials and ideas with which mathematical concepts and skills can be developed (Barrett & Fish, 2011).

Statement of the Problem

What is the impact of instruction using technology on the math achievement of fourth grade students?

Hypothesis

Students in the 4th grade experimental mathematics class, who will be taught through video clips, interactive white boards, every pupil response through ActivExpressions, Study Island, First in Math, and online manipulatives will display no difference in achievement when compared to students in the control group who will be taught using traditional pencil and paper instruction.

Operational Definitions

Mathematics Achievement

Students in both classes will receive the same unit test provided in the curriculum guide by Baltimore County Public Schools as a pretest and a posttest. The two groups will then be compared to determine if achievement was increased. Increase in scores from the pretest to the post test will show that students achieved mastery in the content taught.

Technology

The students in the treatment group will use technology such as: ActivExpressions, Mimio board, flip charts, BrainPop and Safari Montage video clips as well as access to web-based programs such as First in Math and Study Island.

CHAPTER II

This literature review explores challenges to student achievement and identifies strategies that may increase achievement in the classroom. Section one defines and describes what achievement is and what achievement looks like. Section two provides a variety of challenges that prohibit achievement in the classroom. In section three, various strategies are discussed that could be implemented to help students reach their desired level of achievement.

Student Achievement

Although there are quite a few dictionary definitions of the word achievement, it is not something that can be easily given one definition. The online dictionary has three definitions of achievement. The first definition, the one that most closely relates to education, is that something has been accomplished by superior ability; special effort; great courage; or a great or heroic deed (www.dictionary.com). Defining achievement is not as simple as this. The true definition of achievement may differ from person to person, everyone has a different idea of what achievement is and each of us has a different idea of what it is to achieve something. While one student may be excited to earn an A, another student may be happy to simply achieve a C after a series of struggles. Simply put, achievement is all about completing goals that you have set for yourself and reaching for your goals. However, students will not be able to reach these dreams if they lack a strong desire to do just that. Of course students will want to reach their dreams and certainly think about doing so but achievement requires a lot more than this.

Achievement goals represent an integrated and organized pattern of beliefs

about the different purposes or reasons that students may adopt for their learning and academic engagement in achievement situations and about the standards or criteria that will be used to judge academic success or failure (Mägi, Lerkkanen, Poikkeus, Rasku-Puttonen & Kikas, 2010). Throughout all of the articles read and synthesized, achievement is based on whether students did better after interventions were in place using measurement from assessments.

Challenges to Student Achievement

There are many challenges to student achievement. There are times when the student does not have the mental capacity due to varying circumstances that prevent them from learning. Sometimes student motivation also prohibits them from doing their very best. There are a number of other factors that are out of the students' control. Some of those things include: teacher's attitude/knowledge, gender differences, and parental involvement (Peterson, Rubie-Davies, Elley-Brown, Widdowson, Dixon, & Irving, 2011)

Research states that highly qualified and highly effective teachers are the keys to students' academic success (Dash, de Kramer, O'Dwyer, Masters, & Russell, 2012).

There are claims that the "teacher" factor was the most significant school predictor of students' academic achievement, particularly in the area of mathematics. Reforming American education means that we should invest in higher standards for all children (Barrett & Fish, 2011). No Child Left Behind has a focus to close the achievement gap and ensure that low achievers reach academic proficiency. Teachers play a critical role in accomplishing this goal (Konstantopoulos & Chung, 2011). It is believed that highly effective teachers can increase student achievement, especially for minority and highly disadvantaged students. Effectiveness is measured on how well

instruction is delivered. It is important that teachers provide a connection between the instruction and the student. Instruction should be differentiated, focused on learning, high expectations and the use of technology to engage students (Stronge, Ward, & Grant, 2011) . Highly effective teachers should have ongoing assessments so they can see where their students are coming from, how they are doing and what they have learned. The classroom should be a positive and productive learning environment where students know routines and are taking ownership of their learning. Lastly, highly effective teachers should have positive personal qualities. Children need to know we care and want them to succeed (Stronge, Ward, & Grant, 2011). When students are taught by ineffective teachers, than they are at a disadvantage and may not receive the same resources as a student who has a highly effective teacher. Teachers that are highly qualified have been educated in asking thought-provoking questions, using strategies to tap students intellectual ability, planning engaging lessons and the ability to motivate students so that they have all of the resources to achieve. Dash et al. (2012) discusses that students benefit most when they have successive years of highly effective teachers. It is important that we get teachers that can provide for students and meet each of their needs.

People in the United States believe that math is stereotypically a male domain. Gender stereotypes can disrupt girls' math performance as early as five to seven years of age (Tomasetto, Alparone, & Cadinu, 2011). American elementary school children often reflect the stereotypic pattern for academic self-concepts (Cvencek, Meltzoff, & Greenwald, 2011). Elementary girls show a weaker identification with math than boys on both implicit and self-report measures. Math gender stereotypes develop early and differently and influences boys' versus girls' self-identification with math prior to ages at

which differences in math achievement emerge. Societal influences may cause girls to have a weaker self-concept. Some of the influences include cultural stereotypes and intrapersonal cognitive factors. Some other influences include mothers. Developmental theory suggests that parental attitudes are important for the development of children's academic attitudes, beliefs, and performance especially in the area of mathematics (Tomasetto, et al., 2011). Girls whose parents endorse gender stereotypes will be especially vulnerable to negative affects and will have a decrease in mathematics achievement while those parents who reject gender differences will be protected.

The parent-teacher partnership is considered one of the most important factors to ensure a student's success. The degree to which the three main stakeholders (parents, students and teachers) in student learning and achievement believe they are responsible for learning outcomes as an important consideration and component in student success. If the three stakeholders are not working together and perceptions of who is responsible is off, then those conflicting thoughts may be a factor in students' academic learning and success (Peterson, Rubie-Davies, Elley-Brown, Widdowson, Dixon, & Irving, 2011). If parents are not interested in their child's education, then the student starts to take on the same mentality as their parents and will start to not care as well. Students, parents and teachers have the shared responsibility for academic success. The environments in which a student grows up in are likely to have a strong influence on the development of the students' own beliefs. When students are asked who is responsible for their learning, students from a high socioeconomic background believe their parents are responsible whereas students from low socioeconomic backgrounds believe the teachers are responsible. Neither group of students believed that they are responsible. Each

stakeholder wants to take responsibility when there is success but often point the finger at someone else when the student is a failure. All three groups need to take responsibility for failure. Students are the ones who benefit when everyone takes responsibility and plays their vital part in the equation. Research shows that students believe it is important that their parents are involved in supporting and encouraging their education (Peterson, et al., 2011). Effective parent support is not easy. It involves a shared understanding and negotiation among parents, teachers, and school regarding how children should be educated, the role of parents, and access to resources to support such efforts. It is important that parents send their children to school prepared to learn, setting and voicing expectations, supporting their education in and out of the classroom, advocating for the child, and having an open communication with those that deal with the child while in the school building (Shiffman, 2011). Without that support, children will be the one to suffer and may not be able to reach their fullest potential.

Interventions

While there are many challenges that students face, there are interventions that could be put into place to help students overcome those challenges and help them achieve success in their academics, more specifically mathematics class.

Some students may struggle every day while some students may be challenged on particular skills. Either way students can be tutored to help them close the gap. Tutoring can occur through an outside resources hired by the parents, or teachers can spend time before or after school working with the students on an individual basis. These are some of the basic modes of tutoring. However, many teachers feel that they do not have enough time in the school day to work one-on-one with every student. Classwide Peer Tutoring

(CWPT is known to be beneficial in improving student engagement and achievement because many more students can respond in the same amount of time that an individual student would have an opportunity to respond during teacher-led instruction (Kunsch, Jitendra, & Sood, 2007). Classwide Peer Tutoring (CWPT) is a way for all students to get one-on-one help and enough time to practice and learn. For CWPT, every student in the class is paired with another. The teacher writes lessons that one student uses to teach or tutor another. During the tutoring, one student explains the work to another student, asks the student to answer questions, and tells the student whether his or her answers are correct. CWPT has been shown to work for students with all kinds of special learning and behavioral needs his new way of tutoring. Enhancing learning, motivation and achievement are just some of the goals of peer tutoring. There are positive aspects to peer tutoring that include sharing of knowledge, recognize and resolve conflicts, as well as learn another's prospective (Tsuei, 2012). This type of intervention has shown significant increase in scores on computational and math word problems, academic motivation, academic self-concept and social competence. Working in this type of scenario allows for a more individualized approach in that problems can address students specific weaknesses. They will not be overwhelmed by problems they cannot handle, therefore reducing behavior issues and increasing self-esteem as well as academic achievement.

When math instruction occurs, it typically is taught using manipulatives, rulers, calculators, pencil and paper. There is however a way to get math concepts across to children that is often overlooked, that is through children's literature. A lot of students understand skills better through literature due to the context of the information. Concepts

are often taught in terms of words rather than numbers. Students often feel less intimidated when reading a book. Numbers can often overwhelm children and therefore students shut down not allowing themselves to learn a new skill. Literature can provide real-world context for children to understand some math concepts. As stories are being read aloud, students can make the stories come to life. They are completing problems and learning new skills rather than completing math problems on a page. Even if they cannot relate it to their own lives, they may be able to relate it to the life of a certain book character (Golden, 2012). These types of problems, based on meaningful connections, increased the level of interest and motivation of their students, promoted critical thinking, and encouraged communication and justification (Young & Marroquin, 2006). Literature does not only help children access knowledge of math content but it also helps emphasize communication, making connections, and creating representations. Another benefit about literature in mathematics is the integration of multiple subjects into one lesson. Students are able to see the interrelatedness between all subjects and when taught together, students can have a more complex understanding of how subjects relate in school and in the real world. Literature in mathematics connects math and reading (Golden, 2012). Literature can be used to introduce a skill/topic at the beginning of the unit or as a review at the end of the unit. Mathematical ideas are embedded in all types of stories, poems, songs, rhymes, and other forms of literature. Reading is a familiar activity for elementary teachers, and posing problems based on a story allowed the teachers in our workshop to showcase their creativity. Using different forms of literature allowed for different learning styles and offered opportunities for student collaboration.

Games make learning math interactive, fun and engaging. In today's classrooms, students no longer complete endless pages of computation problems the way that many adults did when they were children. Those "drill and kill" methods have been replaced with games, and for good reasons. Games offer many advantages for improving student learning (Clark & Ernst, 2009). Games have long been used to motivate students and help them enjoy mathematics, but there are other benefits of using instructional games in the mathematics classroom. Group games foster discussion among students and using mathematical language is essential for developing reasoning skills and an understanding of concepts (Barrett & Fish, 2011). Such interaction also promotes the development of skills such as active listening, social play, and cooperation. Games also improve students' self-esteem and confidence. The element of chance gives every player the opportunity to be a winner, so students know they can succeed if they have the skill. Most importantly, games can teach. Good games contribute to teaching and learning by providing the materials and ideas with which mathematical concepts and skills can be developed. The following is an example of a mathematics game that develops mental computation skills and associated language while also promoting active listening. A simple game of chess helped students with special needs as it was an authentic context for students' mathematical problem solving. A simple game of chess relates to math as you need to look at the problem/concept before coming up with a solution. General success in mathematics often relies on the ability to recall basic mathematics facts (Stickney, Sharp, & Kenyon, 2012). Accuracy and speed of fact recall often prove challenging for students who are low in math achievement. Students often have strategies that help them recall facts and over time they may master these skills but we would like to see them more

fluent. Quick and accurate recall of math facts is a core skill and prerequisite for higher level learning. Math automaticity is the ability to recall an answer without having to rely on calculation. There are programs out there that help students increase their math automaticity. 24 Challenge is an arithmetic card game in which the objective is to manipulate four numbers using addition, subtraction, multiplication, and division arriving at the number 24. There is also a computer version called First in Math. First In Math allows students to practice and master basic through advanced math skills at their own pace. The program gives the students immediate feedback. Students are motivated by earning stickers each time they get an answer correct. While students are playing the games, they are having fun and skill retention is acquired (Suntex International, 2012)

The last intervention to be discussed is technology “For today’s students, emerging technologies such as mobile learning, online learning, and digital content hold great promise for creating a new learning environment that not only engages them in contextually based content, but also enables greater personalization of the learning process and empowers them to explore knowledge with an unfettered type of curiosity that is too often missing from traditional classroom settings”

(Kiger, Herro, & Prunty, 2012, p 62). Primarily, lectures are the form of learning and teaching used in the education system. While that may work for some students, it does not work for all. Some students may feel overwhelmed by the content while some may be bored. Technology allows students to be self-paced. In a flipped classroom, students could go home at night and see the lesson again on the computer as the teacher would post it online. As students watch the lessons at night, they are able to complete and work through problems during class. It is during that time that teachers can see where students

struggle and can give them one on one attention. Using a classroom that predominately uses technology allows for lessons to be recorded and teachers to learn from each other. Using the flip strategy also allows for parents to see exactly what is being taught in order to help their students. Students starts to feel more invested and eventually achievement is increased (Fulton, 2012). Technology is also easily accessible for majority of the students. Typically students can practice basic facts with flash cards. That is not always fun for the students. There are many programs available (especially on Apple products) that students are comfortable using while also practicing and having fun. There are games involving technology on the smart phones and tablets that allow students to practice math concepts but in a game setting. Students are able to receive immediate feedback while also having fun and improving their skills. There is research that links gaming to student achievement (Kiger, et al., 2012).

Summary

This review of the literature has discussed what achievement is, challenges students face that prevent them from achieving as well as strategies that can be implemented in the classroom to help student reach their fullest potential. Teachers can employ a variety of strategies to induce student engagement and focus, and foster improvement in motivation which raise achievement levels of students. Research shows that while there are challenges, teachers can take responsibility, change instruction to meet the needs of students which in turn will help students achieve their greatest potential.

CHAPTER III

METHODS

The goal of this research was to determine the impact of instruction using technology and the achievement of fourth grade students.

Design

A pretest-posttest quasi experimental design was used in the study. The study included both a treatment and control group. The treatment group consisted of 20 fourth grade students whom receive the Baltimore County Public School's (BCPS) curriculum through the Scotts-Foresman textbook series with enhanced lessons using technology focusing on the content of fractions. The control group was comprised of 21 fourth grade students who receive the BCPS essential curriculum through paper and pencil lessons, no technology was involved in the lessons, also focusing on the content of fractions. In this research, the BCPS unit assessment was used as the pre and post test from the fraction unit provided by the county. The independent variable was the students' achievement on the post test.

Participants

The school in which the study was conducted is located in a middle class area in the northwest section of Baltimore County. It services approximately 892 students, of which 68% are African American, 10% are white, 4% are Hispanic, 12% are Asian, and 6% are two or more races. There are approximately 298 students or 24% of the total enrollment that qualify for free or reduced lunch. The elementary school includes students from kindergarten through grade five. The percent of student attendance is greater than 95.

The forty three students in the study were enrolled in fourth grade. The control group included 23 students, of which ten students were boys and 13 students were girls. The experimental group consisted of 13 boys and seven girls. These classes were intact since the beginning of the school year and both classes are of an average ability. All of the students received the same third grade curriculum, which includes the basic foundations for fractions.

Instrument

The instrument used to measure achievement for all the participants was the unit assessment created by Baltimore County Public Schools for the fourth grade Unit 8 fraction concepts unit (Appendix A).

Procedure

The researcher, a grade four math teacher, received permission from the principal of the school to complete the research during one math unit of the 2012-2013 school year. As stated before, students in both the experimental and control groups attended the same elementary school. Both classes were received the same curriculum however instruction was delivered in a different manner. The study began on April 15, 2013. Both groups met for 60 minutes every day until the unit was completed. At the beginning of the unit students completed a pre-assessment that encompassed all of the skills in the unit. The assessment consisted of 20 questions. Some of the items required students to show their work and explain their answers through constructed response questions as well as selected response questions. The experimental group received their instruction through technology (Appendix B). Every lesson was taught using an ActivInspire flip chart, a program that allows interaction and manipulation on a white board. Students were also

given the opportunity to give an every pupil response by giving their answers through ActivExpressions. These are hand held devices that allow the students to submit their answers without seeing their classmates. The data then shows up on the screen and provides an opportunity for class discussion. It also prevents students from feeling discouraged if they are wrong as no one is aware of who submitted that answer. Students were also shown video clips that explain/reinforce a particular concept taught in class. There was also an opportunity for students to practice their skills using an online program entitled Study Island. Study Island allows teachers to assign assignments based upon what the students are learning. Students can then go on and play games reinforcing taught skills. If students do not get questions correct, it provides an explanation on what the right answer is and why. If students are struggling, the teacher has the opportunity to assign below or above grade level material to help meet the students' needs. The control group will be taught the same skills however instruction will be delivered using the traditional model. At the end of the unit students completed a post-assessment that was identical to the pre assessment. The results of the mathematics pre-assessment and post assessment for both the experimental and control groups were collected and analyzed by the researcher.

CHAPTER IV

Results

The purpose of this study was to determine the impact of instruction using technology on the math achievement of fourth grade students.

The pre- and post- Baltimore County unit test on fraction concepts was analyzed for fourth graders taught using technology and a group that did not use technology using a t test for independent groups. The results of the analysis are presented in Table 1.

Table 1

Pre- and Posttest Results for Fourth Graders Taught With and Without Technology

Test	Group	Mean	Number	Standard Deviation	t	Significance
Pre test	Technology	51.8	20	11.72	1.66	0.11
	No Technology	58.3	21	13.61		
Post test	Technology	83.6	20	12.41	1.58	0.12
	No Technology	88.7	21	12.57		

The hypothesis that there would be no difference in the mathematics achievement of fourth graders taught using technology compared with students not taught using technology is supported.

CHAPTER V

Discussion

This study examined the impact of technology on student achievement vs. the traditional method of teaching. The focus of the intervention was to compare the post test results to determine if technology increased the student achievement and to see if the experimental group surpassed the control group who received the traditional (paper and pencil) method of teaching. There was no significant increase in student achievement for the group who was taught using technology. Both groups, the experimental group and the control group, showed learning did occur but there was no significant difference. As determined in the analysis conducted in Chapter IV, the null hypothesis was supported.

Implications of Results

In this particular study, both groups were actively engaged in their particular lessons. However, the experimental group using technology wanted to interact more with their peers but it is worth noting that their conversations were on topic. They were making the learning more meaningful for themselves. Both of the groups' methods of learning addresses the way students have/are learning in schools. Education has gone through various changes through time. The greatest change comes with the technological age we are currently in. Schools are where students prepare for what is to come in the future. In order to prepare students for the future, we need to incorporate more technology into the schools so students can become efficient with multiple resources that are/will be available to them. Technology helps make teaching and learning more meaningful and fun for the students. Effective technology integration must happen across the curriculum in ways that deepen and enhance the learning process. There are four main

components of learning that must be supported. They are: engagement that is active, group participation, frequent interactions, as well as connection to real-world examples/scenarios. Technology integration becomes effective when the routine is seamless and it supports the goals of the curriculum. The use of technology allows for instant access to enormous amounts of information. Accessing information quickly will benefit students. If a student is struggling, you can find various tutorials to help in understanding. On the other hand if a student finds the content too easy the teacher can enhance their learning by finding more challenging work. Technology changes the way teachers teach the curriculum. It gives teachers different ways to reach different types of learners and assess students understanding through multiple means. It could also change the dynamics of the teacher student relationship. Effective technology integration allows the teachers to become more of a facilitator rather than a preacher. Since technology is constantly evolving, teachers too will need to learn continuously in order to keep up with the change in order to help their students. Students enter the classroom knowing how to use technology in some fashion and are not overwhelmed or intimidated by it. Incorporating it into the classroom will allow students to have fun in a relaxed atmosphere while learning new content.

Threats to Validity

All studies suffer from possible threats to validity. This experiment had several threats to validity that might have affected the results. The first threat could be the two different groups. Each group is homogeneous yet the groups themselves may be a little different. While both classes are labeled "average", the control group is slightly more competent and can move at a quicker rate while the experimental group struggles a bit

more and requires more time to process and comprehend a skill. The students in the study were not randomly assigned to the conditions and the two groups were not equivalent before the intervention.

The second threat to this study was the opportunity to use technology. Up to this point in the school year, students did not have an opportunity to use this amount of technology in the classroom to this extent. Therefore, when we changed our approach to learning for this unit, students saw the technology more as a fun time rather than their learning time. If they did not have the right mindset then they possibly did not reach for the personal best academically.

Another threat would be the length of time it took to complete the unit. We finished the unit in two and a half weeks. If students were given more time to explore all of the resources available to them in order to better comprehend the skills, they may have increased their achievement to a greater extent. Giving more time would also allow students to get over the “it’s new” phase with the technology and will start to focus more on the academic portion of the lessons.

Comparison of the Findings to Previous Research

For today’s students, emerging technologies such as mobile learning, online learning, and digital content hold great promise for creating a new learning environment that not only engages them in contextually based content, but also enables greater personalization of the learning process and empowers them to explore knowledge with an unfettered type of curiosity that is too often missing from traditional classroom settings (Kiger, Herro, & Prunty, 2012). In this study, students did not have the opportunity to personalize their learning. The technology used was planned and implemented by the

teacher. The experimental group was engaged since the learning style was new for them. While they have used video clips to explain various concepts in their learning before, the use of ActivExpressions and flip charts is new to them. In the end, both groups were engaged through different methods and that made learning meaningful for them.

Throughout all of the articles read and synthesized, achievement is based on whether students did better after interventions were in place using measurement from assessments (Mägi, Lerkkanen, Poikkeus, Rasku-Puttonen & Kikas, 2010). This study simply looks at the class as a whole. It does not look at the individual growth of each student from the pre-test to the post-test therefore in order to determine if technology significantly increased mathematics achievement. Students' scores should be individually analyzed to see if significant growth (could be a set standard set by teacher) was made. When looking at an overall class, one student who did poorly could hold back the entire class's average.

Using the internet with the experimental group allowed for more games to be played enhancing student learning. Games have long been used to motivate students and help them enjoy mathematics, but there are other benefits of using instructional games in the mathematics classroom. Group games foster discussion among students and using mathematical language is essential for developing reasoning skills and an understanding of concepts (Barrett & Fish, 2011). Students were very supportive of one another when playing online games and were interested in helping one another be successful so that as a class they could reach a new level. Students were having fun with one another while working on the concept taught that day and building a greater understanding in which they can build upon in upcoming lessons.

Future Research

This research and data can open the door to future research. First I would use groups that are homogenous. The difference in ability could have affected the results. To do this, you would need to give everyone the pre-test and then group them according to the results on that assessment. Therefore you have students of the same ability regarding fractions in the same class.

Even though achievement for this experimental group did not increase significantly through the use of technology, it would be beneficial to know which technique involving technology did help improve achievement as their grades did increase. Multiple experimental groups, each receiving a different mode of instruction using a different piece of technology could have been used to see which one increases more. Although the control group only received the traditional method of teaching, would technology help increase their scores more than they did?

If the time and resources were available, the experimental group could have received another unit of instruction using technology so that they were comfortable with the resources since this is the first time they have been able to use them. When it came time for the study, they would feel comfortable and therefore our instruction would be focused which should increase achievement.

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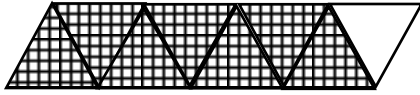
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Appendix A

Unit 8 Fraction Concepts Pre/Post Assessment

1. Which fraction names the shaded part?



☐ a. $\frac{5}{8}$

☐ c. $\frac{7}{8}$

☐ b. $\frac{1}{8}$

☐ d. $\frac{1}{7}$

2. Which circle has the same fractional amount shaded as the rectangle?



☐ a.

☐ c.

☐ b.

☐ d. =

3. Mary was making a necklace. She put 4 blue beads and 6 red beads on the necklace. Which fraction represents the number of red beads?

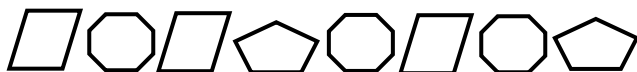
☐ a. $\frac{4}{6}$

☐ c. $\frac{2}{6}$

☐ b. $\frac{4}{10}$

☐ d. $\frac{6}{10}$

4. What fraction of the shapes are pentagons?



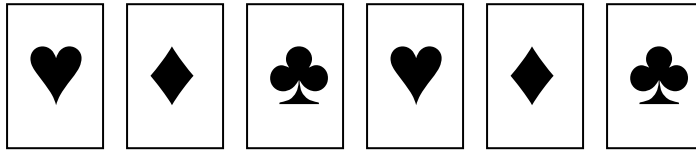
☐ a. $\frac{3}{8}$

☐ b. $\frac{4}{8}$

☐ c. $\frac{2}{8}$

☐ d. $\frac{6}{8}$

5. Malik has the cards below in his hand.



Step A

Write the fraction of the group that names the number of diamond cards.

Step B

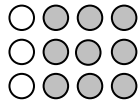
Malik adds two more cards with diamonds on them to his hand.

Explain how adding two more cards changes your fraction.

Use what you know about fractions in your explanation.

Use words, numbers, and/or symbols in your explanation.

6. What fraction is equivalent to the set below?



☐ a. $\frac{6}{12}$

☐ c. $\frac{3}{9}$

☐ b. $\frac{3}{4}$

☐ d. $\frac{3}{6}$

7. Which figure represents a fraction equivalent to $\frac{2}{3}$?

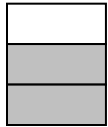


Figure 1

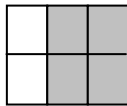


Figure 2

☐ a. Figure 1 only

☐ c. Figure 1 and Figure 2

☐ b. Figure 2 only

☐ d. Neither Figure 1 nor Figure 2

8. Which equation does not show equivalent fractions?

☐ a. $\frac{3}{4} = \frac{6}{10}$

☐ c. $\frac{1}{4} = \frac{2}{8}$

☐ b. $\frac{2}{6} = \frac{1}{3}$

☐ d. $\frac{4}{10} = \frac{2}{5}$

9. What is $\frac{4}{10}$ in simplest form?

☐ a. $\frac{2}{4}$

☐ c. $\frac{1}{2}$

☐ b. $\frac{1}{4}$

☐ d. $\frac{2}{5}$

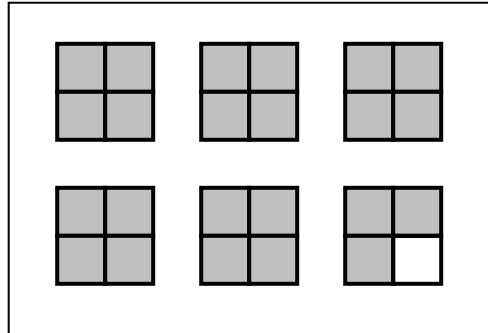
10. Rename the improper fraction $\frac{23}{4}$ as a mixed number.

☐ a. $5\frac{2}{4}$

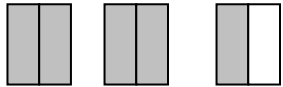
☐ b. $5\frac{3}{4}$

☐ c. $\frac{5}{4}$

☐ d. $6\frac{3}{4}$



11. Which mixed number is represented by the model below?



☐ a. $5\frac{1}{2}$

☐ b. $2\frac{1}{5}$

☐ c. $2\frac{1}{2}$

☐ d. $4\frac{1}{2}$

12. Rename the mixed number $3\frac{1}{3}$ as an improper fraction.

☐ a. $\frac{10}{9}$

☐ b. $\frac{10}{3}$

☐ c. $\frac{7}{3}$

☐ d. $\frac{6}{3}$

Use the table below to answer question 13.

Student	Keith	Terence	Rachel	Min
Part of an Hour Spent Reading	$\frac{1}{2}$	$\frac{7}{10}$	$\frac{7}{8}$	$\frac{4}{10}$

13. Which number sentence correctly compares the amount of time that Terence and Min spent reading?

- ☐ a. $\frac{4}{10} > \frac{7}{10}$
☐ b. $\frac{1}{2} > \frac{7}{10}$
☐ c. $\frac{1}{2} < \frac{7}{8}$
☐ d. $\frac{4}{10} < \frac{7}{10}$

14. Which mixed number makes the number sentence true?

$$2\frac{5}{8} > \square$$

☐ a. $2\frac{7}{8}$

☐ b. $2\frac{4}{8}$

☐ c. $2\frac{6}{8}$

☐ d. $22\frac{1}{8}$

15. Traci needs $4\frac{6}{8}$ yards of ribbon to trim costumes for a play. Which of these amounts is equivalent to $4\frac{6}{8}$ yards?

☐ a. $4\frac{1}{4}$ yards

☐ c. $4\frac{5}{8}$ yards

☐ b. $4\frac{4}{8}$ yards

☐ d. $4\frac{3}{4}$ yards

16. Which set of fractions is ordered from least to greatest?

☐ a. $\frac{5}{10}, \frac{1}{10}, \frac{7}{10}$

☐ c. $\frac{3}{6}, \frac{2}{6}, \frac{1}{6}$

☐ b. $\frac{1}{8}, \frac{3}{8}, \frac{9}{8}$

☐ d. $\frac{1}{4}, \frac{3}{4}, \frac{2}{4}$

The table below shows the amount of spices used in a recipe to make cookies.

Spices Needed for Oatmeal Spice Cookies			
$\frac{1}{4}$ teaspoon salt	$\frac{1}{2}$ teaspoon cinnamon	$\frac{1}{8}$ teaspoon cloves	$\frac{2}{8}$ teaspoon ginger

17. Which spice is used the least in the recipe?

☐ a. salt

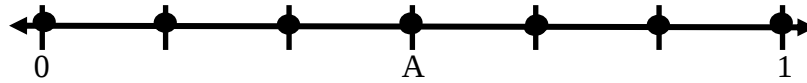
☐ c. cloves

☐ b. cinnamon

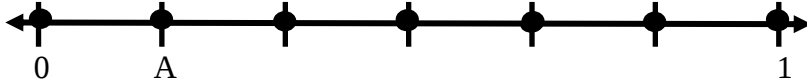
☐ d. ginger

18. Which number line correctly shows the fraction $\frac{5}{6}$ represented by point A?

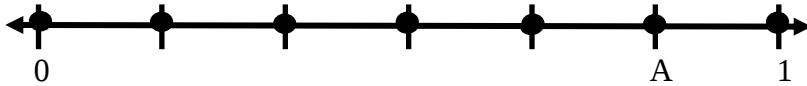
☐ a.



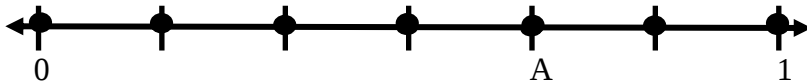
☐ b.



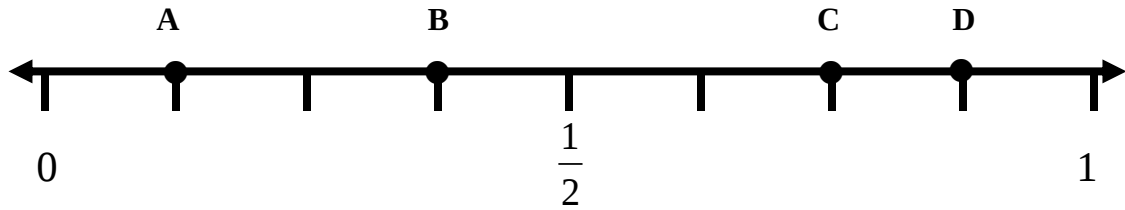
☐ c.



☐ d.



19. Use the number line to complete the question.



Step A

At which point would you place $\frac{3}{8}$?

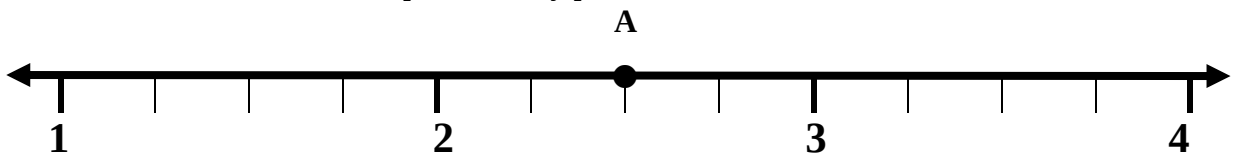
Step B

Explain how you determined your answer.

Use what you know about fractions in your explanation.

Use words, numbers, and/or symbols in your answer.

20. Which mixed number is represented by point A?



☐ a. $2\frac{1}{4}$

☐ b. $2\frac{2}{4}$

☐ c. $1\frac{2}{6}$

☐ d. $2\frac{2}{10}$

Appendix B

Treatment Group for Fraction Concepts April 2013

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
	1	2	3	4	5	6
7	8	9	10	11	12 Preassessment	13
14	15 Video Clip Flip Chart Skill: Area Models	16 Flip Chart Skill: Set Models	17 Flip Chart Video Online Video Game Skill: Fraction on # Line	18 Video Flip Chart iXL.com (additional practice) ActivExpressions Skill: Equivalent Fractions	19 Flip Chart eTools ActivExpressions Skill: Compare/Order	20
21	22 Flip Chart Video ActivExpressions Skill: Mixed #/Improper	23 Flip Chart ActivExpressions Online Game Skill: Compare Mixed #	24 Flip Chart Online Games iXL.com Review Day	25 Post-Assessment	26	27
28	29	30				

