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Using the iPad Application IXL and Its Effects on FAST Assessment Scores

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Abstract

The purpose of this action research study was to determine the effectiveness of using the iPad application IXL during math rotations in the transitional kindergarten classroom and the outcomes of the FAST assessment composite scores. The researcher conducted the study over eight weeks in a transitional kindergarten in Northwest Iowa. Nine students participated eight-ten minutes two-three times a week. The researcher collected quantitative data through the IXL program along with FAST test scores. Results suggest that the use of IXL program advances transitional kindergarten FAST composite scores.

Keywords: IXL, FAST, transitional kindergarten, math

Table of Contents

Introduction

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Early mathematical abilities and students' inabilities to meet state requirements have led to a long-term educational problem throughout the United States. According to a Harvard achievement growth study, (Hanushek, Peterson, & Woessman, 2012) the United States test-score performance is growing slowly at about a 1.6 annual rate in compression to 48 other countries. When looking at the information for the state of Iowa, the new gets worse. Iowa proved to have the slowest overall rate of improvement (pg. 6). As for Iowa educators, it is important to dive into this problem and discover where there is an achievement gap. The kindergarten level is a crucial instructional period for young children to increase their mathematical achievements (Beliakoff, Jordan, & Dyson, 2015). In the early years of school, such as preschool and kindergarten, a child's mathematic knowledge predicts their later success (Clements & Sarama, 2011). Based on the U.S. Common Core State Standards in Kindergarten Mathematics, a child should be able to count to 100 by 1s and 10s, understand one-to-one correspondence and cardinality, compare numbers, add and subtract with the use of manipulative, among other skills by the end of the school year.

Mathematics progression requires a variety of component skills and advances that range in a level of difficulty (Outhwaite, Faulder, Gulliford, & Pitchford, 2019). An effective way to achieve academic progression is to understand the foundational skills that are appropriate for the specific age level (Clements & Sarama 2016). The educational goal needs to focus on specific and meaningful core standards. When teaching young children, educators must remember to incorporate students' natural interest (pg. 78).

There is no question that in today's world that technology has become the new norm. According to The Washington Post, 47% of the world's people are now connected to the internet (Taylor, 2016). As technology has evolved, it has become an impactful learning tool for teachers and students. A few examples of this would be tablets, iPads, SMART boards, virtual reality, and more. "The integration of technology into classrooms can offer many benefits and learning opportunities for both teachers and students" (Lind, 2019). Many schools within the United States have become a one-to-one district, meaning that each student is provided with their own form of technology. This may be an iPad, mac book, chrome book, etc. Touch-screen tablets, such as an iPad, offer hands on and engaging apps to target student's needs. Educational math apps offer opportunities for individualized target learning goals and provide motivation to students (Outhwaite, et al., 2019). Because every student learns at a different rate, the incorporation of an app can help teachers monitor and meet the needs of each individual student. Technology-based learning also provides students with immediate feedback, assistance, and additional activities (Nepo, 2016). The problem with this is there are so many mathematical apps to choose from. How do teachers know which one is the best to meet their student's needs?

The overall purpose of this action research is to see if and how the application IXL affects Transitional Kindergarten students' FAST assessment scores. Students used IXL 2-3 times a week during small group rotations as their technology piece. Student's time on the app was determined by how many questions they got correct. The research question is: How does the application IXL effect FAST assessment composite scores? My hope is to understand if this application is compatible and effective for transitional kindergarten students.

Two definitions to consider throughout this research study are IXL and FAST assessment. According to the IXL Company (2019), "IXL delivers a deeply engaging learning

experience and covers more than 3,700 distinct math topics. Questions are algorithmically generated, meaning students will never see the same question twice no matter how long they practice." "Fastbridge assessments combine Curriculum-Based Measures (CBM) and Computer-Adaptive Tests (CAT) for reading, math and social-emotional behavior (SEB), and delivers accurate, actionable reports for screening, skill analysis, instructional, planning, and more to ensure educators have the right tools and right data to provide timely and targeted supports" (2021).

The literature review contains articles from the past 10 years. The articles were retrieved from using the DeWitt online library through Northwestern College and the education resource information center ERIC. Quantitative data will be collected using excel to show students results from the use of IXL. The charts will show increasing, decreasing, or consistent scores. The quantitative data will be collected through IXL and FAST assessment reports. This action research project will report the growth students made on FAST assessments while using IXL.

Literature Review

The building blocks or mathematical foundation for a student begins during their early childhood education. A young child's mathematical abilities are a strong indicator of what their potential skills will entail for their later academic career (Clements & Samara, 2011). Number identification, counting, comparing, geometry, and more are some key skills that must be introduced to students at a young age. Mathematics is typically taught through a vertical curriculum, meaning as students' progress through their math classes, the skills build upon each other. If a student does not have a strong foundation, they will continue to struggle through the more advanced skills (Guhl, 2019).

Teaching styles continue to change over the years. Teachers have gone from lectures, to chalkboards, to projectors, to interactive whiteboards. Educators have worked hard to find the perfect way to keep students on track, engaged, and motivated to learn. Lind (2019) states that most students in her research state that technology integration is preferred to keep students engaged in their learning experiences.

This literature review will describe the importance of mathematical foundational skills along with the incorporation of technology. The review will acknowledge mathematics, the influence of technology, the modification benefits of technology, and the impact of the application IXL.

Mathematics Instruction

Reading and mathematics are the two-core curriculum focuses in elementary school aged classrooms. However, many children struggle to understand and grasp basic math facts, which lead to struggling with mathematics for years to come (Outhwaite, et al., 2019). With limited time to teach throughout the day and the large number of Common Core Math Standards, early childhood educators are constantly looking for the best instructional strategies. Teachers want to use their time efficiently and effectively (Lind, 2019). Because of this, educators want to know what the best way to instruct students is. Recent studies have shown awareness to this issue and have researched the most effective way to teach early childhood and elementary school students' mathematics.

Ramani and Eason (2015) suggest that early math and numeracy language and skills be introduced to children daily through everyday interactions and especially through play. Through their study with a preschool Head Start Program, students engaged in either a game with colored

pieces or colored pieces with numbers on them. After a two-week period, students with the number pieces showed significant gains in identifying numbers 1-10 as well as their verbal counting skills. After nine weeks, all students were assessed and students from the numbered pieces skills remained consistent where the other students did not share comparable improvements (Ramani & Eason)

Numeracy play is defined as play with the interaction with number toys, shapes, blocks, card games, in addition to counting objects and singing counting songs (Clerkin & Gilligan, 2018). For example, when taking out toys or cleaning them up, an adult should intentionally ask students to sort their toys. As the child is completing the task, use developmentally appropriate academic language such as “sorting,” “grouping”. When the child has completed the task ask them to describe their work. Clerkin and Gilligan (2019) argue that early numeracy play reflects a child’s later mathematical ability. Through their research, 4560 Irish students were surveyed based on their attitudes, confidence, and liking toward mathematics. Their 4568 parents were questioned about their child’s home environment and experiences prior to the start of primary school. Results showed that students who were exposed to more early numeracy play at home showed the greatest difference in comparison to those who had little to none at home (Clerkin & Gilligan).

In contrast to these view, Clements and Sarama (2011) argue that educators believe they are doing mathematics by providing blocks, puzzles, and songs, when, the mathematic content is not the focus. Evidence suggests that this approach is ineffective. In a 3-year study, kindergarten children are with little to no mathematical resources experienced the Number Worlds program at their school. The Number World program is a digital game-based resource that focuses on different mathematical skills such as sorting, counting, cardinality, and more (Clements &

Sarama, 2011). Clements and Sarama (2011) claim that kindergarten students who are using Number World successfully exceeded other students who previously had higher scores. They believe this is due to their puzzles, songs, and other mathematical experiences.

Research-based standards have been developed to guide educators on what should be focused on and taught. Hardy and Hemmeter (2018) agree that direct intervention and instruction promotes larger gains in mathematic abilities. Based on their study with two four-year-old boys, one student met two of his learning goals at 100% and the other student maintained in one area at 50% and made gains in the other area to 60% with the incorporation of direct instruction.

In addition, structured, research-based mathematic instruction has been proven to be effective in growing children's mathematical knowledge. Research insists instruction that furnishes foundational and mathematical experiences in numbers, fact fluency, geometry, and mathematical thinking promotes later school success (Clements & Sarama, 2011). It can be argued that play based learning is very beneficial to students' development, however deeper learning comes from the intentional instruction provided.

Fact Fluency

Many students who enter first grade with delays in mathematics experience falling behind most of their academic career (Dyson, Jordan, Beliakoff & Hassinger-Das, 2015). Math fact fluency is a key foundational skill young students must develop in order to be successful later in life (Berrett & Carter, 2018). Baker and Cuevas (2018) explain that fact fluency is the capability to quickly and accurately answer the four math fact operations: addition, subtraction, multiplication, and division. They also acknowledge that just like students cannot learn to read without understanding letters and their sounds, students must develop automaticity in order to be

strong in fact fluency. Resent research insist that number sense interventions promote growth in fact fluency.

Number sense is defined as basic skills, such as counting and number recognition, number relation, before and after as well as bigger and smaller, and number operation, understanding numbers can be broken down into smaller numbers or put together to make bigger numbers (Dyson et al., 2015). Berret and Carter (2018), argue that effective fluency should be built through drill and practice. When practicing, an appropriate ratio of known and unknown math facts should be presented. Feedback is also a key component. Students should have significant opportunities for immediate feedback with correct answers, so they do not practice incorrectly (Berret & Carter (2018). 63, 3rd grade students from a charter school participate in online Times Attack intervention game. Times Attack is an interactive game designed to teach multiplication by putting students in virtual world where they must answer multiple questions to move forward with the game (Berret & Carter (2018). Results show that students below proficiency averaged 5.5 points increased, proficient students averaged 7.4 points gained, and above proficient students averaged a growth of 11.1 points. Berret & Carter (2018), suggest that Times Attack is an effective intervention to promote fact fluency for students who are generally more proficient.

Dyson et al., (2015) argue that through targeted interventions, students number sense abilities can grow effectively. Baker and Cuevas (2018) agree that students would benefit from effective interventions and an integrated approach. Dyson et al., (2015) study consisted of 188 kindergarten students from four different schools. These school districts were in medium size metropolitan areas. 100% of the students were enrolled in their free or reduced lunch programs. From a provided screener, students scoring under 50% proficient were selected to participate in

an extra 30-minute intervention for 8 consecutive weeks. Students engaged in small groups of 4 students with teacher directed instruction. The intervention was made up of 24 different lessons with targeting fundamental understandings of numbers, relations between numbers, and number operations. For example, students engaged in activities centered on oral counting, quantity recognition, base ten, comparing numbers, combinations, and more based on the students' needs. Results show that students who participated in the intervention increased their assessment score by 25% (Dyson et al., 2015).

Research insists that fact fluency is a key component to student's further mathematic success. It can be argued that there are multiple ways to increase a child's ability to be fluent in different math skills.

iPads

In 2010 Apple created the signature iPad, a new form of technology which was similar to the iPhone as well as a computer. This new tablet became very popular to the public as well as business and school systems. Over 15 million iPads were sold in their first year of production (Bebell & Pedulla, 2015). Currently, iPads are generally the most used form of technology in education (Jimerson, 2018). Recent research has shown great interest to the incorporation of iPads into the classrooms.

Reeves, Gunter, and Lacey (2017), acknowledge that with the incorporation of iPads and a 1:1 learning experience, students' efforts and engagement for learning increase. Their research consisted of 28 prekindergarten students from a rural, public school in Florida. Participants in the study were between the ages of 4 and 5. Many of the children were Caucasian and came from low to middle income families. 20 of the students participated in using iPads to engage in

multiple apps 2 days a week for 15 minutes. The apps used in the study were counting apps, early math skill apps, matching apps for mathematics, as well as phonics apps, rhyming apps, and sight word apps for literacy. Reeves, Gunter and Lacey (2017), express that the researchers were able to choose the skill level to meet each child's needs. Data collected from the Florida VPK assessment suggest that students who participated in the iPad apps increased significantly in the areas of phonological awareness as well as mathematics skills in comparison to the students who did not participate (Reeves, Gunter, & Lacey, 2017).

Bebell and Pedulla (2015), agree that iPads have a positive impact on students' literacy and mathematic performances. In 2011, Auburn Public Schools publicly announced to be one of the first worlds 1:1 iPad school. Pilot Kindergarten teachers formally evaluated different apps targeting literacy and math skills. Study 1 explored literacy improvements and Study 2 focused on mathematics. Each study was for a 9-week period where students participated in in apps focused on reading, phonics, phonemic awareness, math measurement, math numeracy, patterns, and operations. Students were assessed based on 10 ELA subtests and Math scores. iPad students showed greater post gains in their ELA performance scores in comparison to the control group who did not use iPad applications. Similar was true for study 2 with the focus of math scores.

In contrast to these views, Jimerson (2018), argues that there isn’t enough data to prove the significance of using iPads to increase mathematic achievements. During Jimerson’s study 50 third grade students from Plato Elementary School in Chicago were his participants. The 10- 11-year-old students were either participating in instruction given by textbooks or through iPads. The assessment measured students' growth from one year to the next focusing on mathematics. The major finding was that students who used technology scored 197 or higher on their IQ test and improved specifically in the area of money when using technology. However, research

showed that student scored higher on addition problems when using the textbook. Jimerson (2018), emphasizes that there isn't enough data to prove iPads can improve mathematics. Addition research is needed to ensure the benefits in incorporating iPads into math instruction.

Because of these conflicting views it can be argued that more research would be very beneficial. As technology evolves and continues to develop, understanding its benefits is crucial to the education system.

iPads and IEP Students

Accommodations and adaptations are built into teacher's lessons each and every day. Educators understand the importance of meeting each student's individual's needs. Technology has been an important tool for teachers to use in order to make this happen. For example, most devices such as an iPad, have the option to modify the text, language, speech, magnification, and more (Nepo, 2016). Research suggests that students who have an individual education plan (IEP) can benefit from the incorporation of technology into their academics (O'Malley, Jenkins, Wesley, Donehower, Rabuck, & Lewis, 2013).

O'Malley et al. (2013), claim that the incorporation of an iPad application can be an effective instructional tool for students with moderate to severe disabilities. 10 students with IEPs in 7th and 8th grade participated in the four-week study. The dependent variable was the rate of basic math fluency gains, and the independent variable was the time math probe. Students participated in the iPad app Math Racer. During weeks 2 and 4 students participated in iPad app activities to complete timed math probes. To collect the final data, a basic math fluency post-test was used (O'Malley et.all., 2013). Data revealed that students were able to answer more problems correctly per minute during the iPad intervention phases. O'Malley et.all. (2013),

emphasize that the use of an iPad during interventions allows students to master or make progress towards their individual learning goals.

In a similar study, a second grader, third grader, and fourth grader each on a behavior and academic IEP took part in a reach study to understand if iPads could be used to keep students on track (Flower, 2014). Each of the male students used various iPad applications focused on literacy and math. For example, some of the installed programs were: Quick Trap Words, Word Bing, Word Magic, Math Ninja, Marble Math, Math Bingo, and more. Each app provided visual rewards as well as immediate performance feedback (Flower, 2014). Flower (2014) expresses that each student had an average of 65% time on task while participating in paper pencil activities. When engaging in different iPad applications students had an average of 95% of time on task. Flower (2014) agrees that the incorporation of iPads improves academic learning for students with distractible behaviors and IEPs.

In contrast to these studies, Zhang (2014), argues that not all math games meet the needs of each student. A recent study found that approximately 10 million USA internet uses, typically young students, spend 89 million hours a year on a popular math game site. Coolmath-games.com is known as one of the most popular math websites in the United States. When searching for “cool math, math games, and cool math games” there are over 50 million results, with coolmath-games.com consistently being the first listed (Zhang, 2014). There is little to no evidence that the website meets mathematic content. On average a coolmath uses spends approximately 1 minute working on a math lesson and the other 14 minutes playing a game. Zhang (2014), expresses that it is difficult to manage and ensure it is meeting students' individual needs. There is no evidence that it befits students who are on IEPs.

Due to each student learning at a different pace, it is important to teach and monitor all students appropriately to ensure a meaningful education. Technology-based instruction encourages individual instruction, modifications, and immediate feedback (Nepo, 2016). Based on the research it can be argued that technology has a positive impact on students with IEPs.

Methodology

Participants

The action research project was conducted in a transitional kindergarten general education classroom at Sioux Central Elementary in a rural community in northwest Iowa. The participants of the action research consisted of nine students, five boys and four girls. 11% of students were Hispanic and 89% were Caucasian. Two of the students were on Individual Educational Plans (IEP) for speech, one student met with the English Language Learner educator weekly, and one student met with the Guidance Counselor to work on a behavior goal. The students range in age was from 5 to six years old. During the study some students needed to quarantine due to COVID-19 regulations, causing them not to participate during their time away.

Data collection

The purpose of this action research was to determine whether the incorporation of the iPad application IXL improves FAST assessment scores. The students practiced multiple math skills directed to the Core Standards for 8-10 minutes a day, 2-3 days a week, for 8 consecutive weeks. Quantitative data was collected to determine if the use of IXL increased student's FAST scores.

Months before the study, the FAST assessment was administered to students during the fall, September and again during the winter, December. FAST is a universal screening used to assess students on specific math skills? Transitional kindergarten students complete the

kindergarten-leveled test. These skills tested consist of number identification, number sequencing, and decomposing. The number identification section is a one-minute assessment where students are given a page of multiple numbers for them to identify. The number sequencing section has students count forward and backward from a given number and identify numbers before and after given numbers. The decomposing section provides students with a 5 frame and 10 frame visual. Students are then given a number such as two and asked how many to make four? Each student was provided with the same instructions and materials. The educator in a one-on-one setting administered the assessment. After each testing period, the teacher accessed each student's Composite Score Report from the FASTBridge website. The educator was then able to see which students were below the recommended benchmarks for kindergarten. In this research project, the FAST assessment was the dependent variable. The teacher researcher was then able to compare the winter assessment scores to the spring assessment scores.

During the 8-week research period, students were using the online math app IXL. IXL is a comprehensive digital math program for student's pre-school through 12th grade. A classroom IXL licenses for 25 students costs $299 for a full calendar year, which is accessible from home or school. Skills range from counting, skip counting, comparing numbers, sorting, adding, subtracting, and more at the kindergarten level. Once students choose a skill to work on, the program will provide a minimum of 10 questions for that skill set. One benefit of IXL is that if a student answers incorrectly, they will provide a visual of how they solved the problem, the correct answer, and guidance on how to answer a similar question correctly the next time. The student will continue to answer questions but will not see the exact same question they answered incorrectly. IXL will continue to push out different related questions until the student has mastered the skill. IXL provides the teacher multiple reports regarding student's time online. The

researcher was able to see the number of questions answered, time spent online, skills practiced and mastered, trouble spots for each student, students' scores and questions for each skill, progress charts, and go live with the students to see what each student is doing while online. This online data tool allowed the research to reliable and consistent throughout the study.

This action research study was quantitative with two different variables. The dependent variable was the FAST math assessment composite scores. The independent variable within the study was the use of IXL for 8-10 minutes during math centers. The Northwestern Iowa IRB board signed an IRB exemption form. The project was approved. The data collected would be used confidential in respect to the children and their educational privacy.

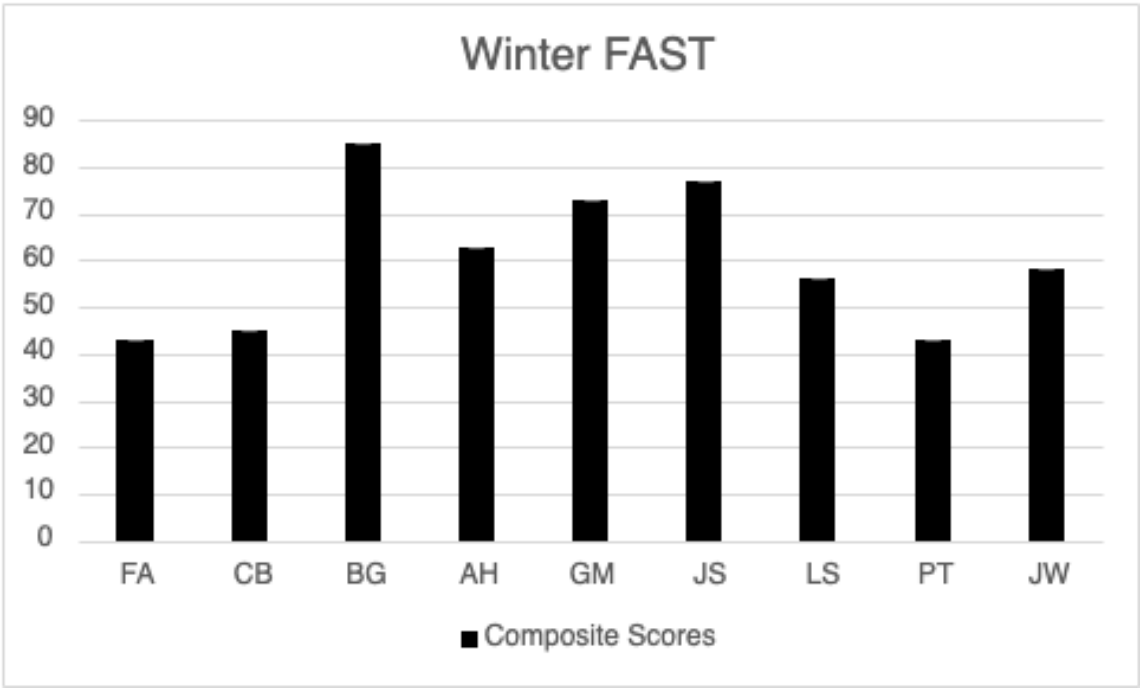
Findings

Data Analysis

The school districts FAST goal for Transitional Kindergarten is to see improvement and to meet fall benchmarks by the end of spring testing. The researcher's strong interest in IXL, engaging math centers, and the support from the math instructional coach, principal, and learning team influenced the planning of this research project. For this action research project, the teacher used quantitative data points to show the impact IXL had on FAST assessment scores. The use of IXL was implemented 2-3 times a week for a period of 8 weeks. Students participated, on average, 8-10 minutes. IXL logs student's questions, answers, time spent, and subject areas practiced. IXL will continue to push out more questions if a student is answering the question incorrectly until the skill is mastered. Because of COVID-19, some students were quarantined for up to two weeks and did not complete IXL activities required each week.

Figure 1

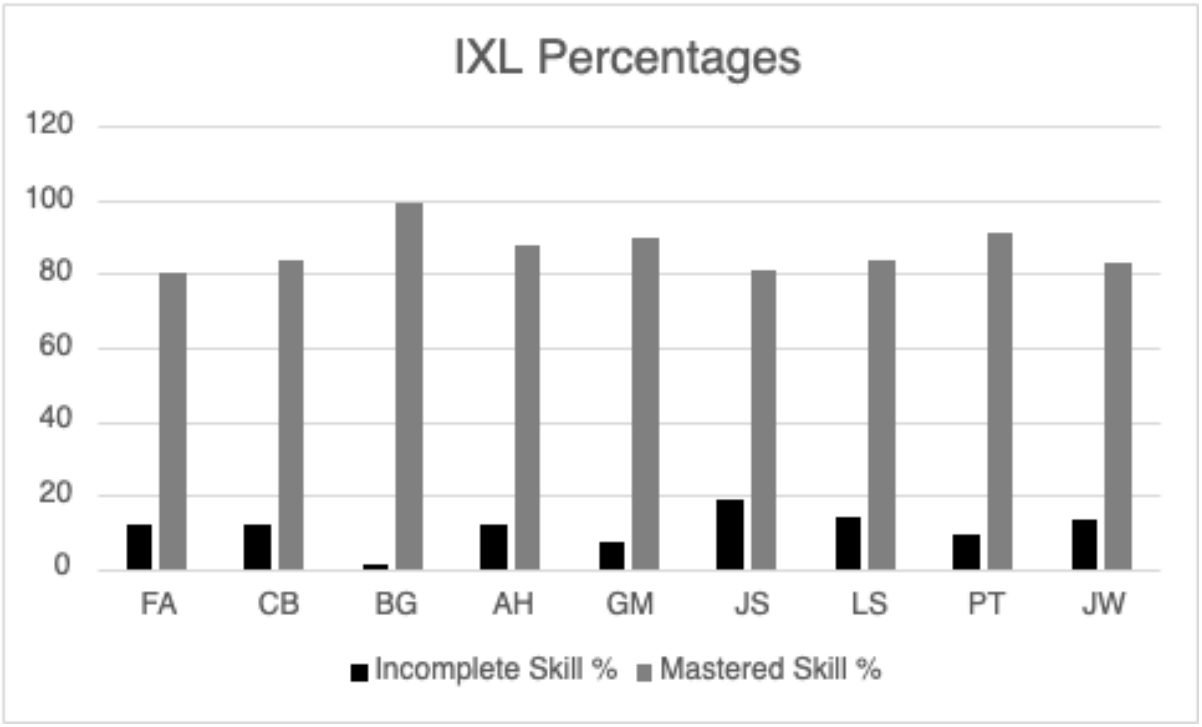
Winter FAST Assessment Composite



Prior to the study, students were administered the FAST math assessment. Students participated in a one-on-one interview with the teacher. Each student received the same instructions and work materials to complete the assessment. Students were tested over number identification, sequencing, and decomposing. Figure 1 shows the composite scores of each of the nine students during winter testing. As observed from the data, 67% of the transitional kindergarten students were meeting the kindergarten winter composite score benchmark. 33% of students being “at risk” for having a composite score lower than 50 points. On average, the transitional kindergarten students scored a composite score of 60 during the winter testing period.

Figure 2

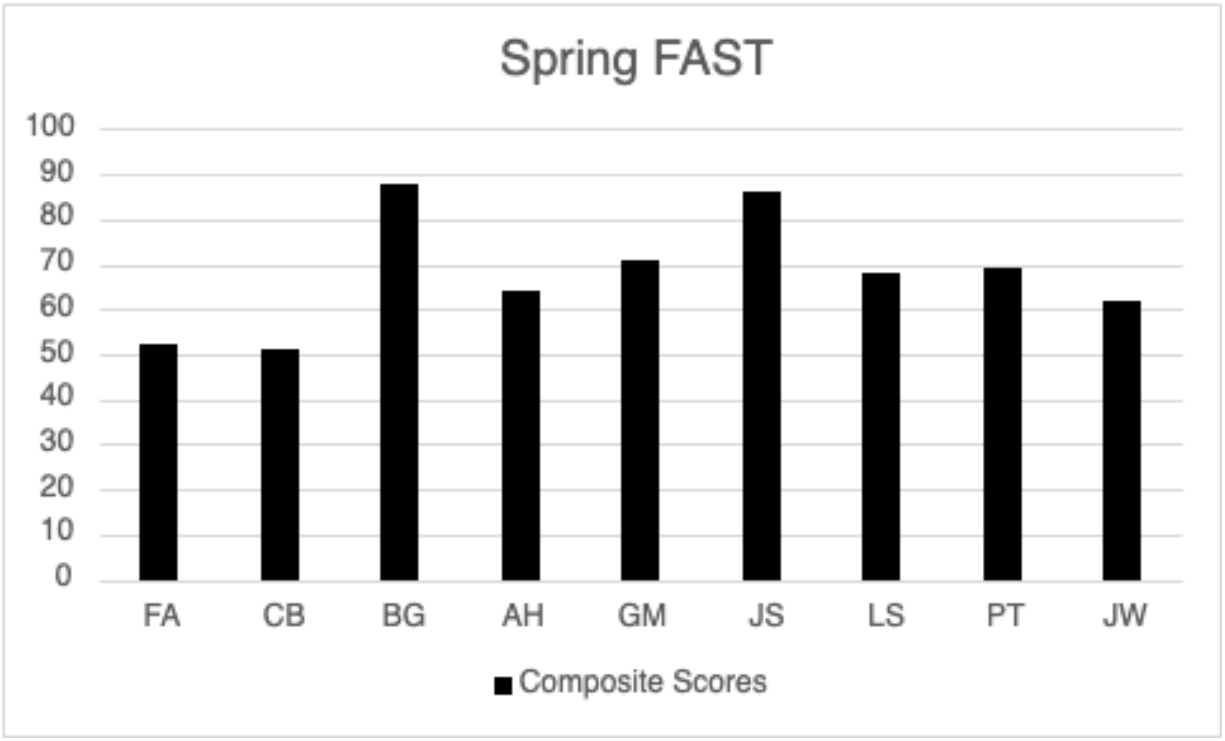
IXL Percentages



The students participate in a range of math activities that align to the Core Standards for 8-10 minutes 2-3 times a week for eight consecutive weeks. Skills ranging from counting, skip counting, comparing, sorting, adding, subtracting, and more. The IXL system documented each student's question log, number of questions needed in order to master the skill, time spent on each skill. The IXL system allows the educator to view specific questions and skills that were mastered or not. As shown if Figure 2, students averaged an 87% level of mastery and 11% incomplete of activities practiced while engaged using the IXL application.

Figure 3

Spring FAST Assessment Composite



Following the 8-week implementation of IXL into math rotation, students completed the exact same FAST math assessment administered by the teacher. Once again, students received identical materials and instructions. Students are assessed over number identification, sequencing, and decomposing. As the school year goes on, benchmarks for kindergarten increase. In order to not be considered "at risk" students must have a composite score of 65 or more. 56% of the transitional kindergarten students were already proficient at the kindergarten level and 44% were considered at risk.

Figure 4

Comparing Composites

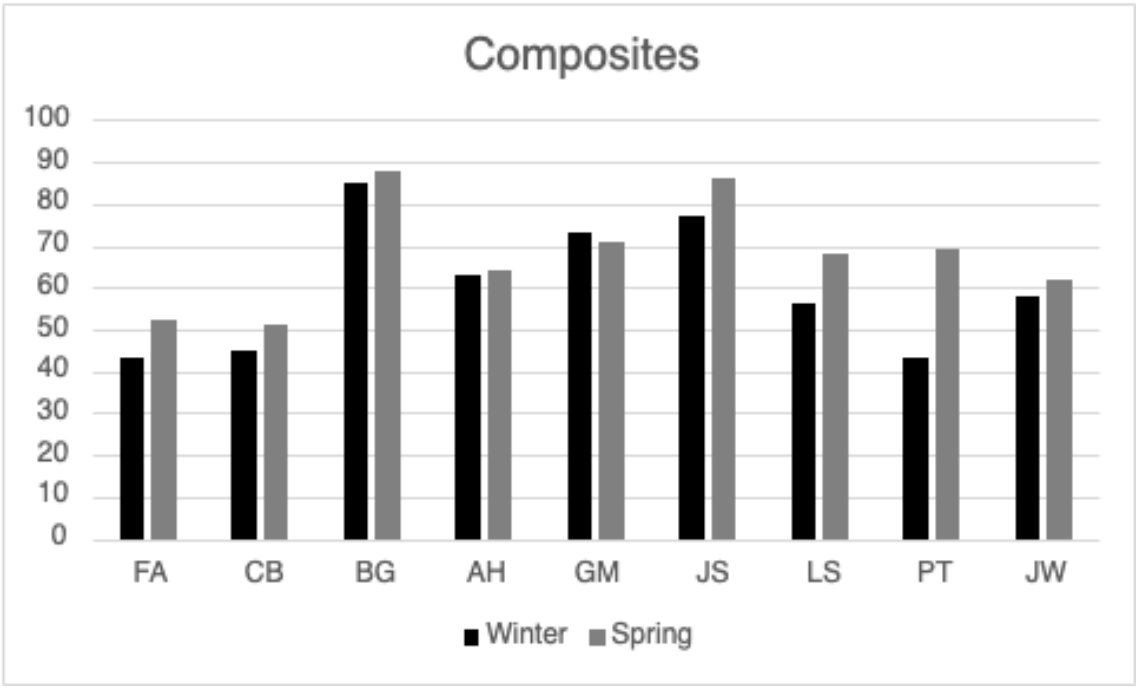


Figure 4 shows the comparison in composite scores from student's winter to Spring FAST assessment scores. Students had an average composite score of 68, which is an 8-point increase. Almost 88% of students showed improvement in composite scores. As seen, student GM lost 2 points on his composite score. This student is one who has trouble sitting still during the second round of testing. This student had special designed independent time due to inability to focus for long periods and was working one on one with the guidance counselor twice a week to practice staying on task.

Figure 5

Percentage of Growth

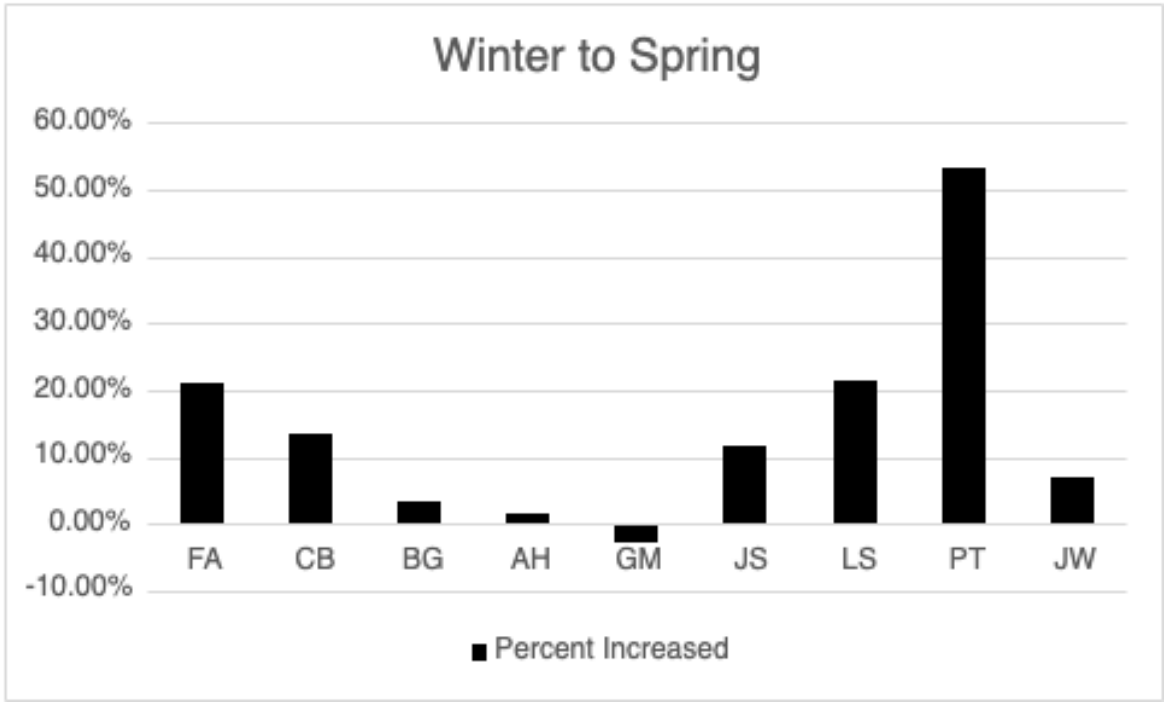


Figure 5 shows the percentage of growth each individual student made from winter to spring. The school district's goal is for the transitional kindergarten students to make growth each testing period and end the year with a composite score higher than the fall benchmark. The fall benchmark for FAST math is a score of 29. 100% of the participants met this learning goal by the end of spring testing. This data suggests that with consistent practice using the application IXL, students can make growth in the FAST composite scores.

Discussion

Summary of Major Findings

The purpose of this study was to determine if the incorporation of the iPad application IXL would increase transitional kindergarten students' FAST assessment scores. To answer this question, students used the application IXL on average 8 to 10 minutes, 2 to 3 times a week, for 8 consecutive weeks. Data collected during this study showed that scores increased by an average of 8 points from winter testing to Spring testing. The finding in this action research suggests that the incorporation of IXL increased students' FAST assessment composite scores.

Limitations of the Study

Many factors could have affected the results taken from this action research. One of these being the number of participants. With such a low number of participants, that data could have been skewed one way or another. Another limitation was COVID-19. During the time of this study students were going through a pandemic which caused some students to quarantine away from school, causing them not to participate during that time. Another factor that could have affected the results was the small group instruction that students were also receiving during the time of this research study that also focused on some of the key foundational skills tested on the FAST assessment. Finally, another limitation could have been the timing of this study. The end of the school year can be a particularly hard time for students to remain motivated and engaged due to the heat and fun end of the year activities that are taking place.

Further Study

There are many areas of recommendations for future research. Researchers should consider replicating the study, but for a more consistent period. Instead of incorporating IXL for 2-3 times a week, students should use IXL as the only form of technology tool during math rotations. Another area to explore is what skills were practiced during the time students were using IXL.

The researcher should consider using a specific schedule, so students are able to focus on multiple skill sets. Additionally, further studies should investigate comparing students to technology-based interactions and non-technology-based interactions. Finally, instead of using the assessment tool FAST the researcher should consider using a fact fluency assessment tool to evaluate the growth made from using IXL.

Conclusion

Early mathematical abilities are key to students' later success. Effective math instruction at an early age is essential for building a strong foundation of mathematical skills. The kindergarten level is a crucial time for elementary students to gain necessary skills for their upcoming education. Technology has been proven to allow educators to meet the needs of each individual student as well as promote educational growth. This action research project was incorporated into a transitional kindergarten classroom to determine if the incorporation of the iPad application IXL increased students' FAST assessment composite scores. The transitional kindergarten classroom participated in an eight-week intervention using the application two to three days a week. The results suggest that IXL improves FAST assessment composite scores. Overall, the use of technology in a game like format made math rotations fun and engaging. In the future, the researcher's intent is to incorporate IXL into math rotations at the beginning of the school year.

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