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The Effectiveness of Student-Centered Technology Use During Early Elementary Small Group Math Instruction

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Abstract

The purpose of this action research study was to determine whether students would show more growth when using paper and pencil activities or technology during small group instruction in mathematics, specifically on the skill of telling time. Data was collected from ten second-grade students over a five-week period. The two intervention groups involved in the study met for equal amounts of time and were given the same tests for data collection purposes. The test questions were randomized pictures of clocks that required students to tell time to the nearest five minutes. One intervention group practiced the skill of telling time using an iPad app. The iPad app gave students game choices, as well as rewards. The other intervention group did not use technology, but rather practiced their skill using traditional paper and pencil activities. The study collects quantitative data to determine which intervention group showed more academic growth.

The Effectiveness of Student-Centered Technology Use During Early Elementary Small Group Math Instruction

During their early childhood years, students are expected to learn a substantial number of skills within the area of mathematics. Although there is some overlap within the Common Core mathematical domains throughout Kindergarten, first grade, and second grade, students are still expected to learn these skills quickly before moving on. Teaching many standards in a short amount of time is just one of the many pressures that teachers face today. Due to the short amount of time to teach a large amount of Common Core math standards, early childhood math teachers are constantly looking for the best ways to instruct students while using time effectively and efficiently.

Many teachers have found that small group instruction is an effective way to give students individualized instruction to fit their learning needs alongside a group of peers at their level. During small group instruction teachers can review math skills for students that may need additional help or can move ahead to the next math skill with students that are ready. Some teachers choose to use technology during small group instruction, while others use the more traditional option of worksheets and paper pencil activities. The researcher sought to discover the best use of time when working with math students in a small group setting. The research question is: Do early elementary math students show more growth with the skill of telling time when using hands-on technology during small group instruction?

The hope is, by completing this action research study on student academic gains in the small group setting, the teacher will be able to use evidence when choosing the teaching strategies to use in the classroom that are the best use of precious time. Given the knowledge

gained from this study, the teacher will choose the materials that are best suited for the students, specifically related to the use of technology.

Review of the Literature

Education has changed tremendously in the last twenty years and these changes include the tools that teachers use within their classrooms. Teachers have gone from using chalkboards to several different types of projectors to white boards to television to video projection to smart whiteboards to network resources. Like with all things in life, all teaching tools throughout history come with their own lists of pros and cons for both the teacher and the students. However, as teachers we must keep ourselves up to date in order to provide students with adequate technical content and proper motivation (del Campo, Negro & Nunez, 2012).

The students that are currently in classrooms across the country are considered digital natives. Prensky (2001) first defined "digital natives" as individuals who have "spent their entire lives surrounded by… the toys and tools of the digital age… and therefore are native speakers of a digital language" (p. 1). A study was conducted by Dietrich and Balli (2014) which included thorough interviews with 34 fifth grade students, whom are digital natives, on their authentic and ritualistic engagement with technology within their classrooms. In this study, student engagement was defined as interest in and commitment to learning. Most of the students interviewed recognized that using technology was an engaging learning experience for them. Some of the devices mentioned by the students in the study were interactive whiteboards, iPads, and computers. One of the reasons the digital natives stated as to why technology engages them is because the devices grab their attention and offer novelty compared to traditional ways of teaching. The largest connection the researchers found that connected technology to student engagement was the control and choice that is involved. When control and choice were involved

in assignments using technology, students tended to focus more on the content they were learning rather than the device itself, offering a true form of engagement in their learning process (Dietrich & Balli, 2014).

Not only can technology offer the benefit of student engagement with their learning, the use of technology in the classroom can also facilitate the development of the teacher-student relationships. These relationships promote positive learning outcomes. "The relationship between instructors and student is at the core students' engaged learning; as such, technology should augment--not inhibit--the formation of that valuable relationship" (Greer & Mott, 2009, p. 7). Technology can enhance communication between teachers and students, as well as collaboration within the trouble-shooting and problem-solving processes associated with the use of technology. Technology can help to balance the power of students and teachers in the educational setting. There is a shared vulnerability when learning to use a new technology which can help strengthen the connection between the educator and the learner, which in return creates a more successful learning environment (Greer & Mott, 2009).

Many teachers believe that when they incorporate technology into the classroom, they are in turn preparing their students for future careers. With the introduction of 21st century skill standards, teachers are encouraged to provide meaningful learning opportunities for students to prepare them to lead productive, satisfying lives. Within the framework of these standards are common strands of learning and innovation; communication, information, and technology; and, life and career skills (Iowa Core K-12 21st Century Skills). A topic that is often brought up in connection with the 21st century skills, is the importance for students to be able to collaborate. Collaboration is an important skill for students to build before entering the work force.

Research conducted by Tess Miller (2018) found that the use of technology, specifically iPads, lead to an increase in collaboration between students. The students involved in the study were thirteen kindergarten students, aged four and five, whom were randomly selected in placed in two intervention groups. One group received a two-week intervention using iPads to learn numeracy concepts. The other group followed the traditional play-based learning activities that also focused on numeracy development. Both groups focused mainly on concepts of number sense. The iPad intervention group began using ten apps for the first week. Each day thereafter the students were introduced to a new app, making a total of fifteen math apps used. The students were given instructions on how to use an app at the beginning of the lesson and then were able to choose the app they preferred for the remainder of the lesson. This gave the students the power of choice, which has proven to be a meaningful way to promote engagement and ownership in learning with students. The difference in the children's understanding of numeracy was measured using pre- and post-tests. The data analysis showed small gains in achievement for the group using technology compared to a slight decrease in the control group using traditional materials. Although the increase was not significant, the researcher still believes that the study provides evidence that using technology in this context did not deter or lesson children's development of numeracy skills. The researcher also believes that the findings from the study will broaden the utility of iPads in early childhood education. What stood out most during the observations, was that the children in the technology group were more apt to collaborate with each other. The children provided help to one another to get to the next level or step within the app. The collaboration appeared to be natural, as the students did not need guidance from the researcher to do so. The students were eager to share what was on their screens. "This affinity for collaboration is an asset to learning mathematics that needs to be

supported so that when children leave the play-based learning environment they are still drawn to helping each other with tasks in general but specifically, in the learning of mathematics" (Miller, 2018, p. 8).

The integration of technology into classrooms can offer many benefits and learning opportunities for both teachers and students, but some may wonder if it is appropriate for early elementary students. In 2012, NAEYC and the Fred Rogers Center issued a joint position statement. The statement was grounded in developmentally appropriate practice and was intended to guide educators in early childhood settings on the selection, use, integration, and evaluation of technology tools for learning. "When used wisely, technology and media can support learning and relationships. Enjoyable and engaging shared experiences that optimize the potential for children's learning and development can support children's relationships both with adults and their peers" (Donohue & Schomburg, 2017, p. 29). Some other takeaways, or advice, regarding technology use with young children are: The quality of what children are viewing on screens is more important than how much they watch. Technology allows for media creation, when students can move from being media consumers to creators. A child's use of technology should enhance interactions and strengthen relationships with others. Technology should be used in such a way that it supports mindfulness, creativity, and a sense of initiative (Donohue & Schomburg, 2017).

Nothing in the education world is proven to be perfect, so with that, technology in the classroom can have some disadvantages. An article that was specifically about the use of hand-held devices in the classroom stated that even though the devices can access important educational resources, they can also expose students to inappropriate advertisements and content. This can result in distraction from their intended academic assignment. Other critics of the use

of hand-held devices in the classroom have said that they can aide in the addiction of electronic simulation that is prevalent in our country. They have also said that technology can often be overused and cannot replace a teacher (Morgan, 2011).

The technology used during this action research project was intended to enhance math instruction in the early childhood setting. The use of technology in the education setting has been compared to the change that occurred when calculators were invited into the classroom. During that era, some teachers believed that calculators would hamper the students' abilities to calculate. However, most opinions were eventually changed. "When calculators came into existence, they brought an end to spending excessive amounts of time on the calculation side of the work, so students could focus on the techniques. iPads have revolutionized the classroom again, bringing the resources of the outside world straight to the student's hand" (McAleese, 2018, p. 7). With technology in the math classroom, students can easily have their questions answered when they pop into their heads, even if the teacher doesn't have the answer as part of the prepared lesson. This type of learning results in a more student-centered learning process. The technology also provides other options for different styles of learning. If a student needs to visualize a type of graph before they can continue with their learning, the technology can aide with that (McAleese, 2018).

A research project was conducted in 2015 to study the implications of using technology for increasing multiplication fact fluency. The students involved were 12 third grade students and the technology used during the three-week intervention period was iPads. There were two control groups in the study. One group of students used an iPad app and the other group used an intervention that included PowerPoint slides but no hands-on technology for the students. The iPad intervention resulted in substantially higher response rates, meaning the students were able

to practice many more facts than the group without iPads. When the researchers looked closer at the efficiency of the interventions, it was clear that the iPad made it possible for students to practice more math facts in less time. The other intervention required students to write out math facts by hand, resulting in fatigue and lack of motivation. The iPad app only required finger tapping on the touch screen. The iPad app also gives the students immediate feedback on the accuracy of their response. Whereas, with teacher-led math fact practice the feedback time would require a longer waiting period for the students. Overall, the researchers found that the iPad intervention was preferred by students, teachers, and parents (Musti-Rao & Plati, 2015).

A mixed-methods research project conducted in 2015 interviewed and observed one hundred children, ages three to eight, as they used six different virtual manipulative mathematics apps. The goal of the research was to study the role of affordances in children's learning performances and efficiency when using virtual manipulative mathematics apps. Some of the findings relate to the research of student growth while using iPads. This research showed improved efficiency for preschool, kindergarten, and second grade students in seriation, counting subitizing, quantity, and skip counting tasks. The results of their research also showed significant gains in subitizing performance with kindergarten age students and skip-counting performance with second graders in only one session. The researchers believe that these findings indicate that early childhood students may be able to make significant gains in mathematics in a short period of time while interacting with iPad apps (Moyer-Packenham, Bullock, Shumway, Tucker, Watts, Westenskowl, Anderson-Pence, Maahs-Fladung, Boyer-Thurgood, Gulkilik, & Jordan, 2016).

Another study investigated the benefits of digital technology compared to traditional manipulatives when used with prekindergarten students. The study included 24 students ages

four and five whom engaged in small group math groups three times a week. The students were divided into two groups of twelve with one group working with traditional math manipulatives such as plastic bears, Unifix cubes, candy hearts, and dice, and the other using digital manipulatives found in iPad apps. During teacher small group instruction, students worked in groups of four or five. Each group was given the same vocabulary, instructions, examples, and range of problems. After analyzing the results of pre-tests and post-tests, the researchers found that both digital and traditional manipulatives are effective tools for improving children's computational skills. At the end of the six-week study, both groups showed significant improvements, suggesting that either digital or traditional manipulatives are appropriate for the group of students involved in the study. Although the results didn't show the benefits of using digital manipulatives, the researchers still suggested that educators integrate digital manipulatives into prekindergarten mathematics curricula. "Digital technologies are cultural tools used by young children in their everyday lives. If children's experiences prior to school are changing to include digital technology so they are naturally seeking it out for learning or entertainment purposes, then early childhood educators can consider examining their curriculum and personal pedagogies in regard to the potential of the technology" (Mattoon, Bates, Shifflet, Latham, & Ennis, 2015, p. 5). The researchers expand further by saying that digital technology digital technology can be developmentally appropriate for all students when used during planned instruction for learning purposes (Mattoon et al., 2015).

The research conducted in this project will be done during small group instruction in the area of math in the early childhood classroom. "Flexible small grouping in mathematics, also known as Guided Math, is a data-driven intervention that matches a student's readiness level for learning with the appropriate instructional strategy, delivering the right content at the right pace"

(Benders & Craft, 2016, p. 2). Small group instruction allows for grouping to be easily changed based on performance of improved competency and skill development. The instruction that take place during small groups helps to address the mixed abilities among students in one classroom. This type of instruction is known as differentiation, which is proven to be an effective teaching strategy to improve student achievement. In 2016, an action research study conducted by David S. Benders and Tracy Craft explored the effects of flexible small groups on math achievement in first grade. Like the research conducted for this paper, they were also observing students on the specific math skill of telling time. During the study, students received instruction within flexible grouping rotation of one hour and fifteen-minute blocks in the skill of telling time to the hour and half-hour. The material that students covered with the teacher depended on their academic needs, level of understanding, and results from their pre-test. Some groups may have needed re-teaching, while others dove into enrichment activities. The research took place during a two-week math unit. The analysis of pre-test and post-test scores, and additional data such as exit slips and individual practice sheets, suggested tremendous growth in student achievement. The teacher involved in the research stated "The flexible small group intervention allowed me to identify and target individual student's particular difficulties. The below-level group benefited far more from small group instruction than from whole-class teaching" (Benders & Craft, 2016, p. 7).

Through a review of literature, it can be said that both technology integration and small group instruction can improve academic achievement in the classroom, as well as being age-appropriate for early elementary students. Research has shown that technology can have a positive effect on teacher-student relationships, collaboration, engagement, and learning. Small group instruction is an effective teaching strategy that allows for meeting the needs of a wide

range of academic levels in students. With that, more research is needed to answer the research question of whether early elementary math students show more growth with the skill of telling time when using hands-on technology during small group instruction.

Methods

Participants

The action research was conducted at Lakeview Elementary School, which houses second grade through fifth grade students. Lakeview Elementary is in Centerville, a small town in southern Iowa. The percentage of students eligible for free and reduced lunch at Lakeview Elementary is 70% (2018-19 Iowa Public School K-12 Students Eligible for Free and Reduced-Price Lunch by School). The participants in the study include second grade students from the 2018-2019 school year. All the nineteen students in the classroom were given the pre-test for this study, which included a random selection of clocks where they were expected to tell time to the five-minute interval. From the nineteen students, ten were identified as non-proficient in the area of telling time. The expected proficiency was a score of 80% or above. The students involved in the study were five girls and five boys. Of these participants, one student has an Individualized Education Plan (IEP) in the areas of math and reading. All students are Caucasian and speak English as their first language.

Data Collection

The action research question to be answered was: Do early elementary math students show more growth with the skill of telling time when using hands-on technology during small group instruction? In order to answer this question, data was collected over a five-week period. The data collected during this project were scores from the pre-test, weekly tests, and post-test that were given to the ten participants of the study. The pre-test scores from the intervention

students were used as a baseline for the data analysis. All the tests were made up of randomized pictures of analog clocks. Students were expected to tell time in five-minute intervals and write the answer beneath the clock in digital form. All test questions were scored based on accuracy, with no partial points awarded. Scores were then figured into a percentage of questions answered corrected and recorded by the teacher onto Google Sheets.

All of the students taking p**art** in the intervention groups were identified as non-proficient in the Common Core Standard 2.MD.C.7 "Tell and write time from analog and digital clocks to the nearest five minutes, using a.m. and p.m." (Grade 2 Measurement & Data, p. 7). For the purpose of answering the research question for this study, the skill of identifying a.m. and p.m. was not included. The ten students in need of intervention were divided into two groups with five students in each group. One group of students, the control group, would meet with the teacher to practice the skill of telling time using worksheets, and paper and pencil activities. The other group, the technology group, would meet with the teacher to practice the skill of telling time using an iPad app. Both groups of students met with the teacher twice a week for fifteen-minute sessions. The weekly tests were given at the end of the intervention session on the second day.

All students in the classroom frequently take part in small group instruction within all subject areas. Both intervention groups were familiar with the norms and expectations of small group instruction with the teacher. The instruction for this action research project was given to students in mixed-ability groups. All students had access to clock visual aids in the classroom, as well as other math resources such as a number line and number grid. The students that were not taking part in the intervention were quiet and on-task throughout the room. The students'

activities varied depending on the day, and included interactive math games on Google Chromebooks, hands-on math board games, and paper and pencil math seat work.

The technology intervention group practiced the skill of telling time in five-minute intervals using an iPad app intended for early elementary student use. Within the app, there are several different practice options for the students to choose from. The teacher narrowed their choices down to two games that were the best fit for meeting the intended learning target. There were two options called: "Set the Time!" and "What's the Time?" While playing the game "Set the Time!", students were given a time to show on the kid-friendly clock on the screen. They used their fingers to drag the minute hand around until both hands showed the correct time. If the student answered the question incorrectly, the app would make them keep trying until they arranged the hands correctly. The goal of the other game option, "What's the Time?", is for students to be able to read the time on an analog clock correctly. The students drag digital numbers on a dial to match up with the time shown on the face of the clock. A fun and engaging feature of the app is that when students have a winning streak during any of the game choices, it will take the students to another screen featuring an animated fish aquarium. The students are rewarded with new fish to admire and are even able to feed them. This was motivating and exciting for the second-grade students.

Findings

Data Analysis

The quantitative data collected for the action research project consists of students' percentage of questions answered correctly. Each student received the same question page; therefore, their scores are comparable. The questions were different each week, but all required students to use their knowledge of telling time in five-minute increments and featured the same

analog clock format. When the researcher recorded the scores into the table, special consideration was given to the students' growth from the baseline and their weekly growth, or growth from week to week. A group average for the weekly score, weekly growth, and growth from baseline was also figured and represented in table format.

Table 1

Technology Intervention Group Scores

	Baseline %	**Week 1 %**	**Week 2 %**	**Week 3 %**	**Week 4 %**	**Week 5 %**
Student A	22	89	89	100	89	100
Student B	0	56	67	100	89	100
Student C	11	22	33	100	100	100
Student D	22	89	89	100	100	100
Student E	22	78	78	100	100	100
Group Average	11	67	71	100	96	100

The quantitative data represented in the first table shows the scores of each of the five students in the technology intervention group, as well as a group average for each week.

Table 2

Technology Intervention Group Growth

	Week 1 Growth from Baseline	Week 2 Growth	Week 2 Growth from Baseline	Week 3 Growth	Week 3 Growth from Baseline	Week 4 Growth	Week 4 Growth from Baseline	Week 5 Growth	Week 5 Growth from Baseline
Student A	+67	+0	+89	+11	+78	-11	+67	+11	+78
Student B	+56	+11	+67	+33	+100	-11	+89	+11	+100
Student C	+11	+11	+22	+67	+89	+0	+89	+0	+89
Student D	+67	+0	+67	+11	+78	+0	+78	+0	+78
Student E	+56	+0	+56	+22	+78	+0	+78	+0	+78
Group Average	+51	+4	+60	+29	+84	-4	+80	+4	+84

Table 2 represents the weekly growth, growth from baseline for each week, and group averages. The baseline scores are all far below proficiency, with one student answering no questions correctly. The expectancy for proficiency within this learning target area is 80% or above. After collecting the baseline scores, students were able to take part in the iPad app intervention for two sessions during the first week. The students seemed to enjoy the app and were quickly showing improvements in the skill of telling time. The average growth from the baseline to week one was 51%, meaning the students doubled their scores after one week of the intervention. From week one to week two of the intervention, the students didn't display as much growth as the week before with an increase of only 4%. By week three, all students were able to score 100% on the skill check. Although students were becoming more confident in their ability to tell time, the teacher continued the intervention for two more weeks and continued the collection of data. The fourth week of the intervention showed a slight decrease in student scores. Although the weekly growth was negative with a group average of -4%, the growth from

the baseline score was still strong with 80%. On week five, all students in the technology intervention were able to score 100%, concluding the data collection period. Students C, D, and E displayed consistent scores of 100% during the last three weeks of the intervention, contributing to the lack of growth shown.

Table 3

No Technology Intervention Group Scores

	Baseline %	**Week 1 %**	**Week 2 %**	**Week 3 %**	**Week 4 %**	**Week 5 %**
Student F	0	0	44	78	78	89
Student G	22	22	44	56	67	89
Student H	11	67	67	78	78	78
Student I	22	56	33	56	67	78
Student J	22	22	56	78	89	100
Group Average	15	33	48	69	76	87

Like the data represented in Table 1, Table 3 displays the scores from each week of the intervention from the students working in the intervention group without technology.

Table 4

No Technology Intervention Group Growth

	Week 1 Growth from Baseline	Week 2 Growth	Week 2 Growth from Baseline	Week 3 Growth	Week 3 Growth from Baseline	Week 4 Growth	Week 4 Growth from Baseline	Week 5 Growth	Week 5 Growth from Baseline
Student F	+0	+44	+44	+34	+78	+0	+78	+11	+89
Student G	+0	+22	+22	+12	+34	+11	+45	+22	+67
Student H	+56	+0	+56	+11	+67	+0	+67	+0	+67
Student I	+34	-23	+11	+23	+34	+11	+45	+11	+56
Student J	+0	+34	+34	+22	+56	+11	+67	+11	+78
Group Average	+18	+15	+33	+20	+53	+7	+60	+11	+71

Tables 3 and 4 are in the same format as tables 1 and 2 in order to easily compare student scores and growth from week to week between the two different intervention groups. The baseline group average for the traditional intervention group was 15%, slightly higher than the 11% for the technology group, but both far below the expected proficiency score. The group average score after one week of the traditional paper and pencil intervention showed growth of 18%. The students continued to grow at the same pace during the second week of the intervention with an average growth of 15%. The next three weeks showed growth of 20%, 7%, and 11%, respectively. This indicates that students grew at around the same pace throughout the five-week intervention, without any weeks showing negative growth. By the end of the intervention, three of the five students had scores of 80% or above, showing proficiency in the skill. Students H and I were not considered proficient but were very close with scores of 78%.

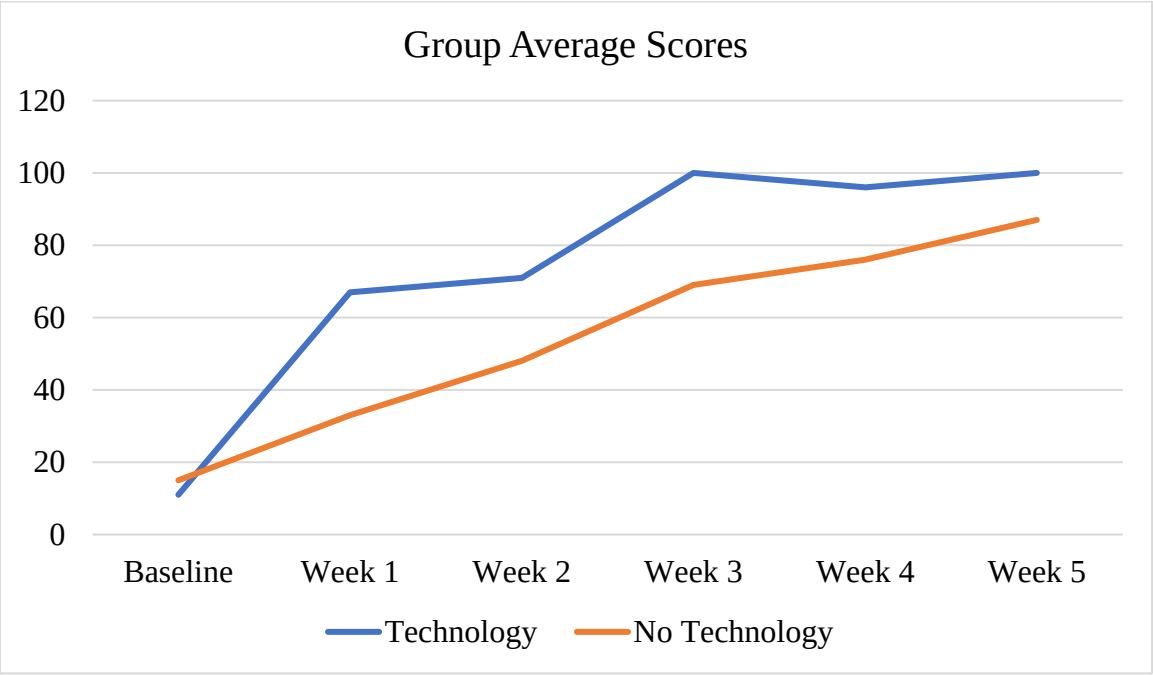

Figure 1. This graph displays the group average scores for all five weeks of the intervention. It is evident that the scores from the students in the technology group were consistently higher than those of the students in the intervention group without technology.

Table 5

Number of Students Proficient (Scores of 80% or Above)

	Technology Group	**No Technology Group**
Baseline	0/5	0/5
Week 1	3/5	0/5
Week 2	3/5	0/5
Week 3	5/5	3/5
Week 4	5/5	3/5
Week 5	5/5	3/5

This table simply shows the number of students in either intervention group that were proficient in the skill of telling time in five-minute intervals during each week of the intervention. Three out of the five students in the technology group were proficient by the end of week one. It wasn't until week three that three out of the five students in the traditional group were proficient. All students were proficient from week three through week five in the technology group. The traditional group ended the intervention with three out of the five students proficient during week five.

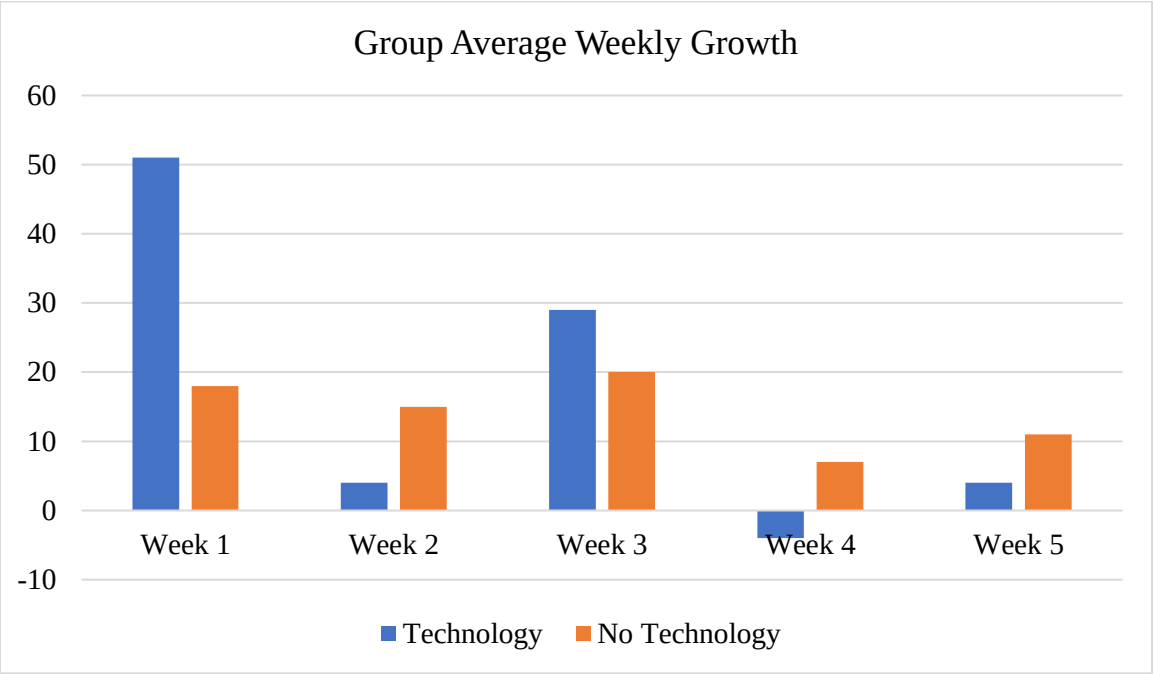

Figure 2. The graph shows the group averages of the amount of growth made each week. After week one, the technology group improved a significant amount more than the traditional intervention group. From there on, both groups went back and forth displaying the most growth. During week four, the technology group showed negative growth. The information from previous figures explains that this was because the students were already considered proficient by this point in the intervention process, so therefore weren't expected to show as much growth.

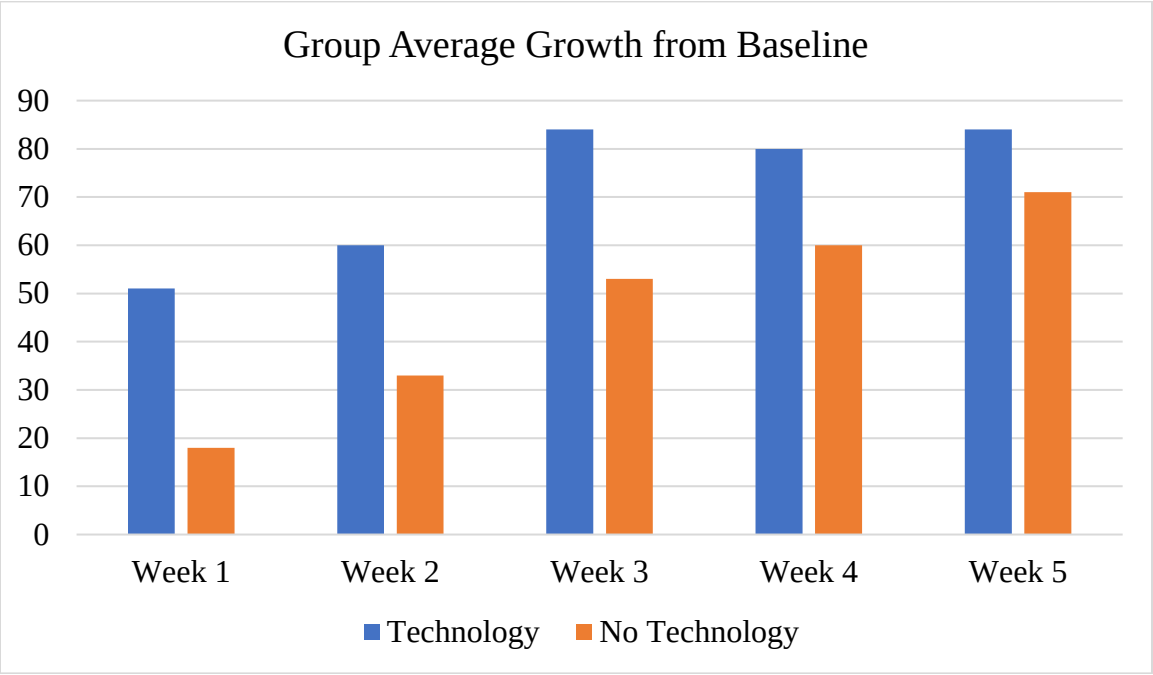

Figure 3. This graph shows the group average growth from the baseline score. This figure differs from Figure 2, as it shows their growth from the beginning of the intervention period up until that point in time. The technology group's growth from the baseline was consistently higher than the group that did not use technology.

Overall, both intervention groups grew from their baseline scores. The technology group went from a group average score of 11% to a score of 100% by week five, an increase of 89%. The no technology group began with an average score of 15% and ended with a score of 87%, an increase of 72%. Both groups showed great growth and were all able to meet proficiency, except for just two students that were only two percentage points away. Teacher observation noted that a major difference between the two intervention groups is that the students in the group that worked with the iPads were more actively engaged and excited about their learning. The students that did not get to use the technology wondered when they would get a turn, showing

interest in the games that were being played. All students were able to practice the skill of telling time using the iPad app after the conclusion of the action research study.

A difference between the two intervention groups that should be pointed out is that the technology group improved at a higher rate at an earlier point in the intervention. After just one week of working with the iPad, three out of the five students were proficient. All five students were proficient by the end of week five. Although the traditional group continued to make consistent growth throughout their intervention process, the technology group showed a large amount of growth after just the first week, with an average group score increase of 51%.

Discussion

Summary of Major Findings

The findings in this action research study suggest that the technology intervention was more successful, as all students were considered proficient prior to the conclusion of the intervention. Although both intervention groups, with or without technology, were able to show growth, the growth of those using iPads during small group instruction occurred earlier on in the intervention process. After just one week, or two fifteen-minute sessions, of the iPad intervention, the students were able to double their pre-assessment scores, or baseline score. This growth was much more significant than that shown from the intervention group that completed paper and pencil activities during their small group instruction time.

What was even more apparent from the observations during this action research study, was that the students that were in the technology intervention group were much more engaged and interactive with their peers. The research shared in the literature review supports the claim that technology use encourages students to collaborate with peers, as well as the teacher. Another reason that students in the technology group appeared to be more engaged was because

the iPad app immediately checked and corrected students' answers, allowing them to move on more quickly. With the paper and pencil activities, students were apt to continue answering questions incorrectly on their papers unless the teacher noticed, stopped them, and addressed the misconceptions. The immediate feedback and redirection often associated with technology use is most likely one of the reasons that students were more actively engaged and successful in their learning. The findings from a previous study conducted by Dietrich and Balli (2014) suggested that when control and choice were involved in an assignment using technology, that students tended to focus more on the content they were learning. The iPad allowed the students to choose the game or activity they liked best within the app that allowed them to practice the skill of telling time. The feature within the app that rewarded the students' accuracy with fish in their virtual aquarium was sure to be another factor in student engagement.

Limitations of the Study

There are several factors that could have affected the results of this action research study. The results are limited to a small number of students, five in each intervention group making a total of ten. With such a small number of students studied, factors such as student effort or life events could have affected their scores and overall data analysis. Another limitation of this study could be the time of year that the interventions took place. The interventions were done during the last few weeks of the school year. It is possible that factors such as heat, end of the year activities, spring sporting events, and lack of motivation could have played a part in the results of the study.

Several limiting factors impacted the scope of this study. The study took place in a low-income, rural community in Iowa with little to no ethnic or cultural diversity in the group of

Caucasian students being studied. It may also be said that the students' prior technology use could be a limitation in an action research study measuring student growth while using technology. The students, as well as the teacher, involved in this study were very familiar with the iPads being used during the interventions. Although the selected app was new to them, students were accustomed to being introduced to new games, apps, and programs frequently throughout the school year. Technology use is common in the classroom in this study; therefore, the results may vary in a classroom where students may be less familiar and comfortable with the technology being used.

Further Study

Teaching strategies incorporating student-centered technology use will continue to be used in the researcher's classroom. With that, the research completed in this action research study has brought forward many new questions on how to conduct small group instruction. The researcher would like to proceed with doing this experiment again involving different math standards, or even a new content area such as reading. The students in this action research study were only working on mastering one standard. The researcher would also like further information on how using an app covering many different math skills during small group instruction could affect overall math content knowledge, such as on a standardized test.

As a result of the findings from this study, the researcher is encouraged to share the information gained in support of using technology in the classroom. This could be done within district in a professional development setting. The topic of the professional development could be technology use, small group instruction, or mathematics instruction. Although the findings from this research are restricted to a specific grade level and math skill, when combined with the

knowledge gained from the literature review, there are many interesting points to share about the benefits of technology use in the classroom. The researcher will continue to work towards choosing the best-fit teaching practices for each group of students.

Conclusion

In this study, the researcher examined the effectiveness of the use of technology during small group math instruction, specifically with the skill of telling time. Two intervention groups were taught the same skill using two different strategies of paper and pencil activities and student-centered technology use through an iPad app. After examining the student test scores over a five-week period, the data analysis concluded that the students in the group that had access to technology displayed higher gains at an earlier point in the intervention. The research explored the connection between technology use and efficient, yet effective, teacher-led small group instruction. The researcher learned, that during this specific research study, students were able to become proficient in the skill more quickly when given the chance to practice using technology. The results of this action research indicate that technology is an effective tool for quality instruction in the early elementary classroom.

This research is important to consider when lesson planning for small group instruction. As noted in the literature review and observed during this action research study, the benefits of technology are not limited to academic gains. The students taking part in the technology intervention group were given more opportunities for choice, rewards, immediate feedback and corrections, and the ability to have meaningful collaboration and conversations with their teacher and peers. The use of student-centered technology during small group instruction in the early elementary math classroom benefited students in many ways.

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