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Action Research Project: Using MobyMax to Increase Student's Fact Fluency

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Abstract

This action research was pursued by the researcher's inquisitiveness about math fact fluency specifically using the technological platform MobyMax Fact Fluency to help boost student's fact fluency. The researcher is a first-grade teacher in her 8th year of teaching. The whole class of 17 students were a part of the class-wide research study. The five-week study examined the use of technology in the classroom. Specifically, the use of MobyMax Fact Fluency to determine if students showed growth in their fact fluency knowledge. Throughout the study, students were progress monitored every two weeks. The data suggests that with the implementation of the technological platform, MobyMax Fact Fluency, students increased not only their facts per minute, but their overall STAR Math scores. The use of technology proved to be a promising tool to aid in the acquisition of fact fluency. Future research would suggest implementation in more classrooms as a whole class intervention.

Keywords: fact fluency, MobyMax Fact Fluency, technology

Math Fact Fluency Practice Using Technology

The Common Core has developed standards for math fact fluency for children in schools. These standards drive instruction to help students become fluent and automatic in their knowledge of math facts. Automaticity defined by Stickney, Sharp, & Kenyon (2012), is the ability to deliver a correct answer immediately from memory without conscious thought, as opposed to relying on a calculation. Automaticity strives for accuracy. Fluency defined by Forbinger and Fuchs (2014) is, "the ability to find an answer quickly and effortlessly, either because the answer is memorized or because the individual has developed an efficient strategy for calculating the answer" (p. 154). Fluency is the ability to answer quickly. Educators are faced with a problem—many students are not fluent and automatic in their fact knowledge.

The National Mathematics Advisory Panel (2008) reported the need for American schools to help students "develop automatic recall of addition and related subtraction facts, and multiplication and related division facts." Students who struggle with fluency can struggle with math concepts and applications, which builds on foundational skills. (Hawkins, Collins, Hernan, & Flowers, 2017). Fact fluency is essential to higher-level math (Musti-Rao & Plati, 2015). If students fail to reach automaticity, their lack of basic math skills will stretch across every level of mathematics (Riccomini, Stocker, & Morano, 2017). Fact fluency can be taught using many different strategies. Specifically, the use of technology gives students a greater level of motivation, which will lead to greater fact knowledge.

The problem can be found in that many students are not fluent and automatic in their fact knowledge. There is an innumerable amount of fact fluency interventions. Some of the most widely used interventions include flashcards, chants, memorization, peer teaching, cover-copy-repair, detect-practice-repair, and technology that are supposed to help students gain fact

knowledge. Teachers are left to determine what intervention would be best for the student, as well as which intervention would help them make the greatest gains academically.

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Research Question

The purpose of this action research is to investigate technology and the impact it has on the improvement of math fact knowledge. Students will practice for thirty to fifty minutes per week. The technology will be utilized as a tool to help motivate the students to continue to practice their math facts. Will the use of a technology source, MobyMax, for 30-50 minutes a week, increase the student's fact fluency? The author wants to know the implications that the self-paced math fact practice will have on their assessment scores.

Throughout the literature review, the articles utilized have a range from 2002 to 2020. Articles were found through the DeWitt Library with the use of a variety of search terms. Examples of these search terms follow: technology, motivation, collaboration, theories, cons of technology, and fact fluency. The primary focus of this literature review is to identify how the use of technology in fact fluency relates to academic success.

The author will identify various themes throughout the literature review. These include the following: researchers and their perception of fact fluency, technology as a motivational and collaboration tool, fact fluency's impact on academic success, the importance of fact fluency practice, and the cons of technology in the classroom. As a result of the literature review, the author will determine if the use of technology will alter a student's success in math fact fluency.

Literature Review

In today's world, educators continue to utilize and monitor the efficacy of various kinds of technology and how they could impact learning in their classroom. Technology is ever present. Children have access to it at any given moment, not just in the classroom. Today, students are being exposed to technology and a myriad of devices. Technology is present in some way, in students' home settings. Through the utilization of technology, students can have a greater connection to the world around them. Teachers want to utilize this real-world connection in the classroom to help develop new skills for their students.

Technology has secured its place as an integral part of the math classroom. Elementary classrooms continue to supplement their curriculum with different activities to build their fact fluency (Hawkins, Collins, Hernan, & Flowers, 2017). Fact fluency is a foundational math skill. Students who are fluent in their facts will have less math-related anxiety and are able to complete more complex math related tasks (Parkhurst et al., 2010). If students do not reach fact fluency it will have consequences that reach each level of mathematics (Riccomini, Stocker, Morano 2017). Students can find success with the use of technology as a supplement to evidence-based teaching strategies.

This literature review will describe theories related to technology and its potential impact in a classroom setting. The review will discuss the attainment of math fluency, technology's ability to increase student motivation and collaboration, the benefit fact fluency has on student learning, and the influence of technology on relationships. Potential drawbacks and the effects of improper use will also be discussed.

Theories

When students learn new things, they must process the new information by organizing and storing it in their brains. This process is called encoding (Miller, 2011). As students learn; they manipulate the information to transfer it to long-term memory storage (Arnold, 2012). The labeling of this information by the student is important because they need to have the ability to recall it from their brains. If we drill and practice more frequently, the more the learning becomes strengthened in the brain and retained for a longer time (Zahn, Guo, Chen, & Yang, 2018). The more the math fact data is recalled from memory, the stronger the learning (Arnold, 2012). Technology, as a tool, can provide the vehicle for the brain to go into long- term memory and find and recall the facts. If a child is doing this with frequency, they can become automatic in their fact retrieval and knowledge. This process has been labeled automatization. Automatization is the process that used to require conscious awareness, but then becomes more and more automatic (Miller, 2011).

There have been many different strategies and ideas as to how to practice fact fluency. Educators have used flashcards, chants, songs, technology, or even plain memorization. For a student to become fluent in any skill there must be practice. That means students are processing and strategizing each problem when seen. The brain is constantly being stimulated. The more the brain is working and stimulated, the easier it recalls the information (Zhan, Chen, & Yang, 2018). Practicing a skill repeatedly, specifically addition and subtraction facts, helps with transferring it to long term memory.

Vygotsky believed “A more competent person collaborates with a child to help him move from where he is now to where he can be with help.” (Miller, 2011) Vygotsky would pair a more competent student with a less competent student. This strategy would benefit both students in different ways. The less competent student gains more repeated practice of the facts and reteaching if necessary. The more competent student gains deeper knowledge by teaching others.

Hawkins, Musti-rao, Hughes, Berry,& Mcguire (2009) found that peer tutoring was beneficial for students. The main reason why peer tutoring is beneficial for all students is because each student operates in their zone of proximal development. The tutor enhanced their math facts by providing scaffolding to the other student. This theory does not allow for differentiation for all students. The student who has mastered the skill is spending time teaching the other student instead of moving on to new, more complex skills.

Technology as a Motivational and Collaboration Tool

Technology-based programs and devices can be viewed as a motivational tool. Educators understand that each student in the classroom has a different learning style (Felder & Spurlin, 2005). Educators strive to meet and engage students through the use of different activities. These varied activities allow a variety of learning styles to be addressed. Integrating technology into the classroom allows instructors the opportunity to teach towards different learning styles. (Dyer, Larson, Steele, & Holbeck, 2015). Incorporating different learning styles in a lesson have many benefits—students will be reached, engaged, and motivated (Gilakjani, 2012, p 110).

Technology can provide opportunities for independent work for students but also can act as a tool to promote collaboration and social interaction (Clements & Sarma, 2002). Young children gravitate towards an environment that is inclusive. Young children typically prefer an

environment where they can work together. This inclusive environment is beneficial for their language skills.

The utilization of collaboration for educational purposes makes it a powerful tool. Collaboration allows students to hear other perspectives, share ideas, and brainstorm problem-solving ideas (Dyer et al., 2015). As students progress through their education, they are able to both identify how they solve equations, as well as, allow them to see and hear alternative options from others. Working with others can enable students to show more interest in the work as well (Clements & Sarama, 2002). A classroom that promotes collaboration also fosters inclusion (Ciampa, 2014). Technology has the power to remove the barriers to learning, it puts all children on a level playing field, and engages the learners (Ciampa, 2014). By collaborating with others, it requires them to be metacognizant of their learning and learning style.

The device or technology-based program allows students to be involved in the lesson. Technology can be engaging—students may become so engrossed by it that they lose awareness of what is happening around them. Wyatt (2017) stated the following: "If the device is an integral part of the lecture through student-response applications, then the device is an engagement tool rather than a distraction or barrier." When teachers use the program or device for a variety of activities, students can be engaged and motivated in a variety of ways. "Using technology as an instructional tool in the classroom may aid students in their motivation to learn increasingly difficult material." (Kuyatt, Holland, & Jones, 2015) If students lack motivation, students will fail to be involved. Through the use of technology, we may be able to better motivate and engage students.

Students need to understand how the material that they are learning applies and connects to real world situations. It makes the learning more authentic. Students who see the real world in the setting of the classroom may have greater motivation (Binnur, 2009). Students attempt to apply the things learned in the classroom to the real world. When students "see the real world in the classrooms they can be motivated easily." (Binnur, 2009). Technology can be a powerful tool in the application of learning.

Teachers in classrooms with one-to-one devices have the expectation that technology will provide greater motivation for students. This greater motivation, hopefully, leads to growth in academic success. When students are more motivated to work, their learning is more authentic (Binnur, 2009). Authentic learning has a greater opportunity to lead to mastery of skills and growth as a student progresses through their educational career.

Academic Success

Content presentation and achievement assessment are two specific areas that can be extremely valuable to students and teachers in the classroom with the use of technology (Davies, Dean, & Ball, 2013). Computers and technology are useful tools to help and aid learning in the classroom (Clements & Sarma, 2002) The use of the internet has granted, both students and teachers, access to a multitude of resources.

The technology tool utilized is determined by the learning outcomes desired by the teacher. The variety of educational sites or applications affords the opportunity for the teacher to tailor the learning experience. One application or educational site may be more suited for one particular type of content or skill strand. Other sites may be needed to develop other important skills. Many sites and applications can track the progress of work for the student. This is an

important tool for teachers—teachers can determine the progress of a student in their mastery of skills or lack thereof. This progress can serve as important data points as students work towards their learning goals.

Teachers continue to search for new ways to supplement and strengthen the math skills they are teaching in their core instruction. Technology is a tool that can be used in addition to direct instruction from their teacher (Alejandre & Moore, 2003). Many school systems provide devices and technology for their students and teachers. Technology promotes personalization and differentiation of the lesson for students (Sota, Clarke, Nelson, Doabler, & Fine, 2014). Students in a classroom have a wide range of abilities, and "technology can allow teachers to more effectively instruct students within this wide range." (Sota et al., 2014). One student may need more practice on a specific skill, while another student may be ready to be challenged.

Technology allows for differentiation. Differentiation is the personalization of learning to meet the learning needs of the individual student (Davies et al., 2013). Differentiation allows students to move through the given material at their own pace and needs. First, the teacher must identify the level of skill for the student. Next, the teacher must find meaningful and purposeful instruction for the student. This learning must be flexible so that the student can continue to work through the skill and move on when mastery has been demonstrated by the student. Differentiation allows the teacher to challenge one student, while reteaching others. Teachers can meet the students at their current location in their educational journey and help them progress forward.

Timely feedback is an integral part of a student's educational experience. Technology is a valuable tool because it offers immediate feedback to students. When a new skill is practiced

on a website or application, immediate feedback is provided to the students, so they know if they have correctly answered the question or problem. This immediate feedback can be highly motivating for students to continue practicing on a targeted skill. The more the technique and skills are practiced, the more permanent they become for the student (Scheeler, McKinnon & Stout, 2012). It is essential that students practice the skill correctly. Without corrective intervention, the student will continue to do the skill incorrectly. Through immediate feedback, students can fix their answers as well as process the way they solved the problem. Immediate feedback can intensify the performance and enhance the outcome (Duhon, House, Hastings, Poncy, & Solomon, 2015). Immediate feedback also communicates their current performance to the students. This allows them to see the distance from where they are currently to their desired score. If the student is struggling, they have the opportunity to come back to a particular problem while working on subsequent problems.

Immediate feedback is important to the teacher as well. When students log on to a website, their data and progress are being saved. Teachers are able to track the progress of the student on these websites. The data collected offers a glimpse into the student's progression—accuracy and progress can be examined more closely. The teacher can supplement the learning with additional or more diverse instruction, as they see fit to better meet the student's needs.

Fact Fluency

Baker & Cuevas (2018) stated the following: "Developing automaticity is a building block for the success of students in the math classroom. Just as students cannot read with understanding without first learning the correct process for sounding out words and memorizing their sight words, math students cannot "read" math without learning their basic math facts."

Math facts prove to be a critical building block in mathematical learning. “Before any comprehension can take place, whether in reading or in math, automaticity of sight words or math facts must be achieved to improve comprehension.” (Baker & Cuevas, 2018). Students must seek to understand the complexity of the problem rather than just the basic facts of the problem.

Fluency in a skill can be determined by how quickly and successfully something can be completed. The response is rapid and accurate (Parkhurst et al, 2010). Students do not stumble through it, and they answer with minimal effort. Students are not trying to apply strategies as to how to complete the problem. That takes too much time and can be mentally tiring. Instead, one simply knows the answer.

The fact practice for the students needs to be targeted, purposeful, and planned (Riccomini et al., 2017). The activities should target the student’s deficits and help improve their math performance. Teachers pinpoint these deficits by utilizing the data they previously collected from their website. Activities that are repetitive can become mundane and students can lose interest in the task (Hawkins et al., 2017). This is why teachers should always strive to keep instruction, practice, and feedback timely and relevant.

When discussing the topic of math facts, individuals may have them memorized or obtained a strategy that helps them complete it quickly. Adults or students who are farther along in their mathematical journey do not actively think about how they acquired their skill proficiency, because they have already moved on to automaticity. Students who lack automaticity in their fact knowledge can become frustrated and struggle in math. Students who are committing their working memory to basic math computation are more likely to experience

anxiety when asked to complete math problems (Musti-Rao & Plati, 2015). The reason for this is due to the fact their working memory is so "full" and focused on solving basic computations that when they are asked to do a more complex process, their brain is overloaded. Students who are automatic in their facts are able to focus more on the concept and application problems (Hawkins et al., 2017).

Teachers have utilized a variety of methods of fact practice in classrooms. Flashcards, board games, playing cards, and worksheets are examples of tools used to help students practice their math facts. These activities can be done independently, but they lack the all-important teacher component. Students can solve problems incorrectly without realizing their mistakes. This can lead to the continuation of error in problem-solving without having a strategy presented to them to help them understand further. This can lead to bad habits or the allowance for students to memorize an answer incorrectly. This incorrect practice can take longer to correct and reteach the student the correct way to do a problem than if a student had learned it correctly from the start. Therefore, students should have immediate feedback when practicing their facts (Musti-Rao & Plati, 2015) because fact knowledge is such a foundational math skill (Hawkins et al. 2017). Fact knowledge helps students in their current math journey. Fact knowledge helps reduce the cognitive load, reduce frustration, and will save student's time. However, its importance will continue to be a vital component in their math development as students begin more complex math that requires more processing.

The Cons of Using Technology in the Classroom

Bonilla discussed in his commentary, how technology has played a role in personal life while highlighting some of the negative consequences of technology. Bonilla listed six potential

negative effects of technology in the classroom: limiting pedagogy in teaching for cultural competence, reinforcing the digital divide, constraining the potential for a holistic humanistic education, privileging one style of communication while limiting broader approaches, transforming teaching into sensory deprivation, and diminishing standards of academic excellence.

Technology has different stages of use in a classroom. Teachers and students must know how to operate the device to utilize the technology in the classroom. Students must be instructed on the operation of the device before it can be used for any educational purpose. Students must also learn the proper use of the website or application. There needs to be explicit instruction before technology can be successfully implemented into the classroom. This can be time-consuming. Troubleshooting issues also arise through this form of instruction. Issues with technology can lead to frustration for both students and teachers.

Technology is not without its limitations. One such area that educators should take into consideration is that of cultural bias or limitation. "Current technology is limited in its ability to accommodate a variety of cultural expressions..." (Bonilla, 2011). In many cultures, technology does not aptly describe their identity or beliefs (Bonilla, 2011). If the instruction is reduced solely to technology, students would lack an understanding of other's interests and culture. Emotion is not effectively conveyed while using technology. The lack of personal connection and these afore mentioned concerns should be taken into consideration when teachers are designing their instructions.

Another factor that should be considered when using technology is internet access. Student access to the internet in their home environment can also be stressful to students and

families. This can lead to inequality for students as those who lack resources are punished due to their low socioeconomic standing. Teachers need to ensure that all students have equal opportunity for success as much as possible.

Bonilla argues that technology cannot be the only instructional tool because we fail to educate the whole student. Students may teach academic skills, but that fails to educate the whole student. Students must learn how to interact with others through interpersonal contact. Students must learn to have respectful disagreements, convey their needs and wants, and how to make good choices for themselves and others. Teachers must educate students on social situations and how to handle their emotions. Technology lacks the ability to shape students' social skills.

Although these points from Bonilla are accurate, they only prove that technology is not the sole mode of teaching students, but instead that "teachers should be careful to only use technology as a supplement." (Jones, 2016) Jones and Bonilla argue there are many cons of technology, but a recent study by Calderón, Meroño, & MacPhail (2020) showed evidence that the use of technology was beneficial. Researchers found that with the integration of technology in the classroom, there was a "positive learning environment that led to optimal values of intrinsic motivation and academic achievement" (Calderón, Meroño, & MacPhail, 2020). Similarly, Berrett and Carter found positive results incorporating technology in the area of math fact fluency. Berrett and Carter (2017) found that the role of Computer Assisted Instruction was able to aid in improving math fact fluency.

Much time and research have been dedicated to finding the most effective ways to help students become more fluent in their fact knowledge. However, some of this research excludes technology and can be outdated. Some of the more modern practices of technology use in the

classroom are still relatively new. Additional educational applications and sites are constantly being developed for student's use in the classroom. As schools continue to place more devices into the hands of their students and teachers, additional research must continue to investigate and document the efficacy of technology in the area of mathematical learning and math fact acquisition.

Technology is ever-changing and has found its place as a permanent strategy in the field of education. Technology offers efficiency and extra support for teachers as they navigate what tools best fit the needs of students. The Common Core Standards for Mathematics does an exceptional job of ensuring that students are building their foundational math skills. The Common Core Standards for Mathematics are age-appropriate and sequential in nature. The Common Core Standards build upon one another to ensure that there are fewer gaps than traditional math curriculums. A noted weakness in math curriculums is that of math fluency. A weakness in curriculums can be identified in math fluency. Math fluency often is not explicitly stated or included in the curriculum. This research was conducted to provide more information on how to better understand how the usage of daily math fact practice for the duration of 30-50 minutes a week, would boost their fact knowledge.

Methodology

Participants

This action research study was conducted in a first-grade general education classroom with 17 student participants. This research took place in a public elementary school in a rural Northwest Iowa town. Participants in this study were comprised of eight girls, 12% Hispanic, 12% African American, and 25% Caucasian. There were nine boys, 23% Hispanic, 29% Caucasian. The learners were engaged in the utilization of the educational platform MobyMax Fact Fluency. All of the student participants were engaged in face-to-face learning in a traditional school setting. However, they may have been subjected to a quarantined period due to COVID-19 protocols. Students who were quarantined may not have received their school device immediately, therefore may not have completed all the same minutes others received in this study.

Data Collection

This study will answer the following question, will the use of a technology source, MobyMax, for 30-50 minutes a week increase the student's fact fluency? Students will practice fact fluency on the educational site MobyMax. MobyMax is a standards aligned learning platform that promotes independent practice in the curricular areas of math, literacy, science, and social studies. The learning platform contains numerous settings that allow teachers to differentiate the learning that the students received, based on their individual needs. Educators can assign specific standards or skills to any student or customize the time limit one must work in a specific topic. All the student work is recorded and reported to the teacher. It serves as a

reliable progress monitoring tool that drives instruction for students. The targeted assignments allow students the opportunity for additional practice and reteaching of certain skills.

Students worked in the Fact Fluency strand. The participants began the study in the focus area of addition facts. Upon completion, students were transferred to subtraction facts. The learning platform MobyMax tracks the active working time in the site, not just the time the site is open in the browser. The time stamps of each student's Fact Fluency working time will be downloaded each week from MobyMax's time summary. The duration of the study will be five weeks. The student participants will be actively engaged in fact practice for 30-50 minutes each week.

STAR Math data will be collected using the students Chromebooks, and the timed tests will be collected using paper and pencil. The STAR Math test will be administered before the implementation of this action research. Students will also take a two-minute timed test comprised of addition and subtraction facts with sums or minus up to 20. Students will be progress monitored every two weeks with a two-minute timed test. At the conclusion of the study, students will repeat the STAR Math test and the two-minute timed addition and subtraction facts up to 20.

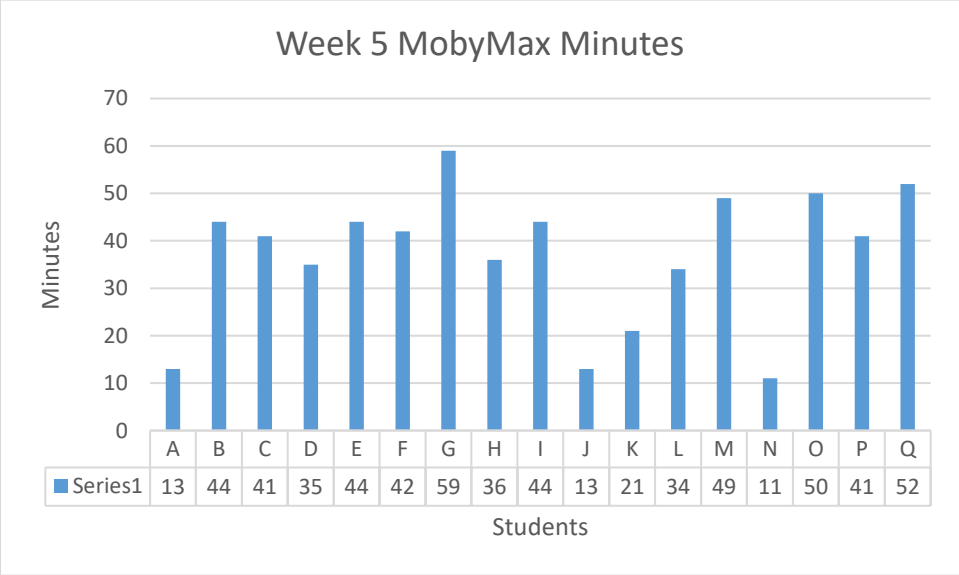
This action research study is qualitative. There are two different variables within the study. The independent variable is the use of the learning platform MobyMax Fact Fluency for 30-50 minutes a week. The dependent variable will be the student's math fluency achievement. An IRB form of exemption was filed, and the data will be kept confidential to respect the student's educational privacy.

Findings

Data Analysis

Throughout this action research study, MobyMax Fact Fluency was implemented daily. On a daily basis, the participants practiced, on average, ten minutes. Chart 1 shows, in detail, the minutes each participant logged within the five-week study. MobyMax logs only student active work time. It should be noted that the MobyMax program only records the work time when students are actively engaged in learning. An open browser did not account towards their daily or weekly accrued minutes. Because of COVID-19 and quarantine protocols, some students were not able to complete the required time each week or during a particular week during the five-week study period.

Chart 1



Prior to the study, students were administered the STAR Math test from the Renaissance website. The student's STAR Math scores were then arranged in a grade level format from

lowest to highest. These scores ranged from below first grade level to second grade seventh month. Three students were considered at-risk and received pull out support from district specialized services on a daily basis for 20 minutes. They focus solely on the area of math. The breakdown of score analysis is as follows: three of these students tested below the 25th percentile, zero students in the 25-49th percentile, seven students in the 50-74th percentile, and six students in the 75th percentile. Students were asked to complete addition and subtraction two-minute timed tests. Students completed the timed tests to establish baseline scores. The baseline established from the written two-minute assessments scores showed that students could complete a range of 5-34 problems in a minute. It should be noted that none of the students who participated in the study received special education services. The mean scaled score in STAR Math of the participants before the study was a scaled score of 374. Chart 2 goes on to show how the students ranked in percentiles prior to the study.

Chart 2

PR Distribution Summary

Percentile	Students	Percent
Below 25th	3	19%
25th to 49th	0	0%
50th to 74th	7	44%
75th & Above	6	38%

The students practiced fact fluency for 30-50 minutes a week. At the conclusion of the study, the participants were tested again, and the average scaled score was 399. The average

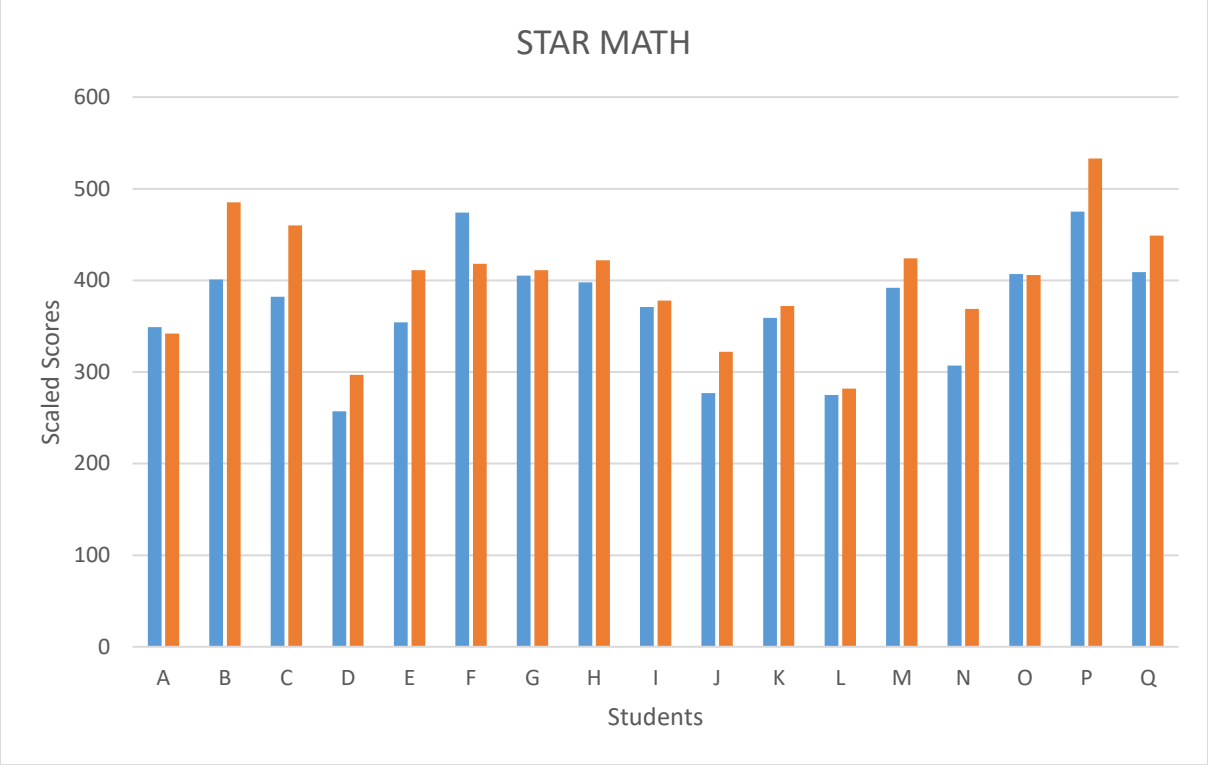
student growth was 25 points. One student tested below the 25th percentile, three students in the 25-49th percentile, five students in the 50-74th percentile, and seven students in the 75th percentile as seen in Chart 3. All participants STAR Math baseline and ending scores were recorded in Chart 4. All but two participants showed growth from the baseline score to the ending score. It is unclear as to why two of the participants did not show growth. The testing conditions and environment were consistent from the baseline testing to the final testing. It is unclear if the student was distressed about events outside of school or what the student's frame of mind was during the assessment.

Chart 3

PR Distribution Summary

Percentile	Students	Percent
Below 25th	1	6%
25th to 49th	3	19%
50th to 74th	5	31%
75th & Above	7	44%

Chart 4



Students also completed two-minute timed tests in addition and subtraction. Chart 5 and Chart 6 show the baseline and concluding data of how many addition and subtraction facts each student completed in two minutes. Students did not move on to fact fluency subtraction practice until they completed the addition facts. Students showed an average growth of 13 addition problems, and an average growth of seven subtraction problems.

Chart 5

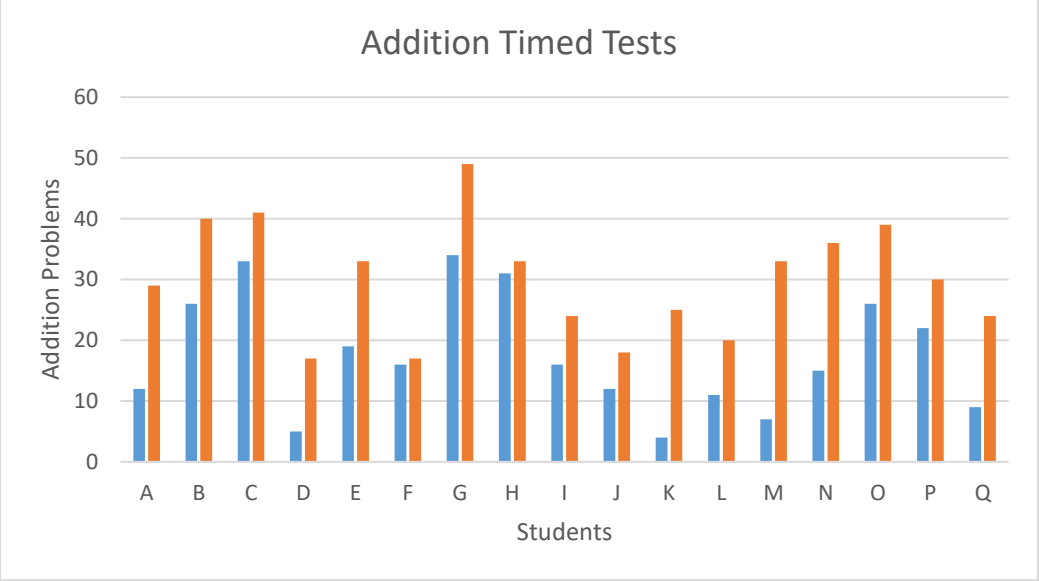
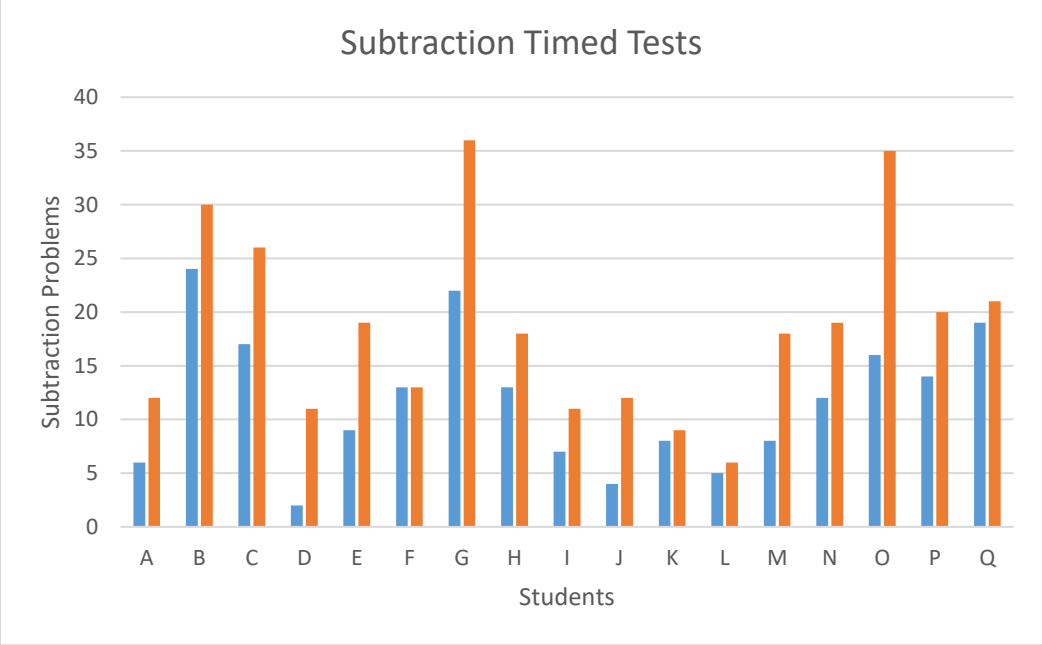


Chart 6



This data suggests that with consistent practice, using a tool that is engaging, students can make growth and retain fact fluency. The findings show that the use of technology was

beneficial and provided motivation for the students. Secondly, the remedial teachings provided by the MobyMax program, for a student who may have answered incorrectly the first time, helped them to learn the correct answer quickly and efficiently.

Discussion

Summary of Major Findings

The use of the technology was one tool implemented in this action research. Using technology-based instruction can offer numerous benefits. Some of the benefits that MobyMax Fact Fluency, the technology tool implemented in this study, offers are immediate feedback to students and teachers, progress monitoring, differentiation, and increased engagement. The participants showed that with direct, intentional fact fluency practice, using a method that promoted motivation, students can make consistent gains in their fact knowledge. With this data, educators should consider using MobyMax Fact Fluency in their classroom instruction. Using the learning platform, teachers actively are meeting their students' learning needs. In addition, struggling students are motivated to learn while getting retaught, if needed. Technology served as a motivator for students to do the necessary repetition and practice of fact fluency. Another benefit that the MobyMax Fact Fluency tool provided was the essential immediate reteaching when a student needed it. This allowed immediate reteaching to the student to fix the fact answer rather than continuously practicing the fact incorrectly.

This action research findings are consistent with what has been found from previous studies. Hawkins et al. (2017) and Burns et al. (2012) have also found favorable results in using technology alongside standard classroom instruction in aiding fact fluency. Musti-Rao and Plati (2015) have reported that technology improves student learning outcomes in mathematics. Overall, these findings are favorable and demonstrate that the use of technology can be beneficial for teachers and students in the area of fact fluency.

Limitations of the Study

The limitations of the study include: the length of the study, COVID-19 pandemic, and students who leave for intervention time. One concern about the findings is that the duration of this study was only five weeks in length. Five weeks does offer valuable information, however additional time would allow for more detailed data to be collected. A major source of limitation is associated with COVID-19. Students who were exposed or tested positive for COVID-19 went into quarantine. In some cases, that meant that the student's family may not have been able to pick up their school device days after their quarantine started. In other cases, it may have meant that some students did not have adequate access to the internet to a reliable internet connection. These factors did not allow the students to complete their minutes in MobyMax Fact Fluency. The final study limitation that should be noted in this study is that students were receiving math intervention during their math work time.

Future Research

A number of recommendations for future research are given. Researchers should consider replicating the study, but for a longer period. This study was five weeks in length. While it offered favorable results, with more time and data, further information regarding if MobyMax Fact Fluency would be provided. In addition, future research should examine the length of time each participant spends daily or weekly on fact fluency practice. This research focused on weekly time. Other future studies should look at varying lengths of time to find the best results for students. Lastly, further studies should investigate and compare student's growth using the technology-based MobyMax Fact Fluency and non-technology-based fluency practice. This would offer insight into students' motivation to practice their facts, in relation to their rate of growth.

Conclusion

The foundation of a student's mathematical education needs to be strong for the student to find success. With a strong foundation, students can continue to build their mathematical knowledge. An essential part of each student's mathematical foundation includes fact knowledge. Many children in math classrooms are not fluent and automatic in their fact knowledge. This action research was put in place to find if the use of MobyMax Fact Fluency for 30-50 minutes a day would help students become more fluent in their facts. This study showed with intentional practice time the majority of the students not only were able to become more fluent in their fact knowledge, but in turn, their STAR Math scaled score also improved. Considering that fact fluency is so foundational, the more a student increases their math fluency, the more it will translate to other areas in mathematics. Going forward, this study shows intentional fact fluency practice should be implemented into a student's mathematical instruction. The data shows the use of the technology platform MobyMax Fact Fluency can improve student's fact fluency knowledge.

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