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Kelsey A. Till

Northwestern College - Orange City

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Abstract

The purpose of this action research project was to determine if adding a technology based literacy apps in a general education second grade classroom could increase the reading scores of the Informal Decoding Inventory that was given to second grade students, throughout a four month period to check personal growth. It will also look at other reading assessments in reading throughout the time frame, but for the purpose and time of this project the researcher will strictly be looking at growth through the inventory. Technology enriched phonemic awareness with a focus on decoding words, recognizing word patterns and fluency interventions and apps were provided weekly over a period of two months. Data was collected through qualitative observations and quantitative Decoding Inventory scores. Analysis of the data collected suggests that second grade student's word decoding scores increased when students were introduced to technology based interventions.

Using Technology to Boost Reading Scores Through Decoding Words

A student needs many supports in order to become a strong reader. Word phonics and decoding are essential components of strong readers.

“Phonics is the ability to identify that there is a relationship between the individual sounds (phonemes) of the spoken language and the letters (graphemes) of the written language. Decoding is being able to use visual, syntactic, or semantic cues to make meaning from words and sentences. Visual cues are how the word looks, the letters themselves, and the letter combinations or groupings and their associated sounds. Syntactic cues are how the sentences are structured and how the words are ordered. Semantic cues are how the word fits into the context of the sentence as in the part of speech, the association with pictures, or the meaning cues in the sentence.” (Tankersley, 2003)

Before a student can be a fluent accurate reader they have to be able to decode words and have a phonics based background to understand the sounds before they can form words or read them. Phonics and decoding is an integral part of early literacy and a method of ensuring that children have the necessary skills to be literate and develop the skills needed to read. It is an important component in a child’s literacy development and should be a part of our literacy instruction. Strong phonics and decoding skills provide a concrete foundation for learning to read and this will influence student success in their ongoing years.

Phonics instruction includes teaching students all parts of the phonemic system which includes the smallest unit of sounds, referred to as a phoneme. Children learn to use phonemes to

help them speak and make sounds that they put together to make words eventually. There are 40 phonemes in the English language, though this number can fluctuate based on dialect and accent. A phoneme helps a child to determine the difference between words such as cat/ hat and tall/fall.

Another part of phonics that students need to acquire before they are truly successful readers is called a grapheme. A grapheme is the minimal unit of a writing system or the letters and letter combinations that represent a phoneme. The English language has 26 graphemes, most commonly associated with the American alphabet. Grapheme knowledge is a necessary skill for verbal explanation of phoneme representation. For example, a student must understand the symbol “B” is called “b” before they can verbally discuss its presence in word format of a child’s first name; example “Your name is Bobby. Bobby starts with a” B.”

The relationship between phonemes and graphemes is known as sound-letter correspondence. It is the connection between the sounds in words and the letters that are used to represent those sounds. Children use the skill of grapheme-phoneme correspondence for phonetic reading skills. Children must understand the letters of the word “cat” are C-A- T. This representation and understanding of sounds is known as phoneme segmentation. Word phoneme segmentation is the ability to break down words into individual sounds in order to form the word and its meaning. All of these different parts of phonics need to be established before a child can decode a word and improve their fluency and word recognition.

The students in the building from grades K-5 students are required to complete the Formative Assessment System for Teachers (FAST) Curriculum- Based Measurement in Reading (CBMR) test three times per school year. This test is designed to measure a student’s ability to read accurately and fluently. In K-1st grade students also take additional test through the FAST screener to identify a variety of phonemic awareness skills. These skills include print

concept, letter naming and sounds, non-sense words, and word segmentation. When a student has a strong foundation of phonemic awareness and phonic skills there is a positive correlation between early literacy skills and the ability to read. 2nd grade through 5th grade also give additional screeners to determine where readers are struggling. Some use the Informal Decoding Inventory and some have started using the PSI with 95%. The school district has purchased both the Walpole intervention system kits and the 95% intervention kits. Second grade students will be starting the year using the Walpole interventions so students will be given the Informal Decoding Inventory along with the FAST testing to determine interventions that best meet their needs.

During the Informal Decoding Inventory students are asked to simply read words aloud to the researcher. They can break the apart but they have to read the word as a whole word to get the word correct. Students at the beginning of second grade should be able to get to the r-controlled words. This means that they should be able to read the short vowels and consonant blends and digraphs. With FAST reading they should be reading at 58 wpm with 80% accuracy.

This paper focuses on an action research project that looks at what effects if any does adding technology based interventions along with teacher based intervention does for students decoding scores and reading scores in general.

Literature Review

In the academic journal titled *Technology and Teaching Children to Read*, Kleiman and Peterson (2004) focus on the use of reading technology in correlation to the development of literacy skills. Kleiman and Peterson (2004) worked with researcher Diana Sherman to dive into how technology can be used to help increase reading in children. Kleiman and Peterson (2004)

present the idea that there are five different areas associated with having an effective reading program in the school. The five areas of focus for Kleiman, Peterson, and Sherman (2004) are phonemic awareness, phonics instruction, fluency instruction, vocabulary instruction, and text comprehension. These five areas need to be intergraded for children to learn to successfully read. This article specifically focuses on how to add technology into the five dedicated areas.

Sherman (2004) the researcher shares that there are four general capabilities that computers and technology can provide to support readers. The four components that support readers are: presents information and activities to students, assess student's work, respond to students work, and provide scaffolds, such as access to word pronunciation and definitions that help students read successfully. These technologies do not just have to be on the computer, these technologies can be audiobooks/ tapes and now days the iPads/ iPods are great tools. When the four components that Sherman (2004) researched are broke apart, it gives a better look into how technology can be used in the classroom to help readers. When looking at how to present information and activities Kleiman and Peterson (2004) explore different ways of how teachers can present the information. Sherman (2004) suggests using multimedia to present information because it can help with auditory and visuals. These types of materials can include speech, text, music, animations, photographs, or videos. Technologies can use one or more of these features to help readers become stronger readers and develop a deeper understanding of the text. Another feature that makes using technology beneficial is the ability to set the speed and pace of the program. Using technology is also great for any English language learners (ELLs) as you can change the language in some programs to help them understand the text in front of them. Using these technologies also allows students to work at their level in terms of what they understand in the phonics sense, vocabulary practice and fluency. Sherman(2004) additionally researched on

assessing students work while using technology; addressing how computers can be used to record students' progress and work, it can also help to organize information and report information in different forms. Tracking student progress is great way to see growth or standstill. This data is important to us and we look to develop our daily instruction for our students. The third component is responding to students work in reading. This is a key component that looks at giving students feedback while they are reading. This might look like students reading aloud and correcting them needed and asking them questions about the reading to see their understanding level. Sherman(2004) found that feedback from the computer can give immediate feedback in forms of additional chances, hints, messages, celebrations when the answer is correct. As Sherman(2004) concluded in the research and Kleiman and Peterson (2004) wrote about the research the emphasize was on how to scaffold so to that help students to read successfully. This means using different forms of technology and using strategies that meet the students' needs. Computers and other technologies can provide the scaffolding that helps students to become stronger more confident readers.

The article written by Kleiman and Peterson (2004) then goes back at looking at the five components of a reader and provides different ways that technologies can be used to teach/ work on the five different components. An important point that Kleiman and Peterson (2004) state at the beginning of the article is something that we need to keep in mind while looking at our curriculum and how technology can help our readers; they say “ Knowledgeable and dedicated teachers are the critical element in a successful reading instruction program (p. 2).” Thus adding new technology and reading instruction teachers need to remember that we are the key element in teaching children how to read and become better readers.

Methods

Participants

This action research project was conducted in a general education second grade classroom. There were nineteen students, nine females and ten males and the ages range from 7-8 years old. The student's demographics show a class that is predominately white and many students identified as low socio-economics status. Of the nineteen students in the class, one receives special education for reading and one receives special education for behavior. Two of the students are currently being tested for special services for reading. None of the students have a para professional or require adaptive technologies.

Data Collection

The focus of the action research project was to determine if adding a reading technology into the students' weekly skills would increase their word decoding scores on their decoding inventory and eventually their FAST reading scores; however for this study based on the timeline The researcher will strictly be looking at the decoding inventory scores that will be given three times during this time frame. Both qualitative and quantitative data was integrated to determine if the technology intervention increased student decoding scores. The purpose for using both quantitative and qualitative data was to gather a more complete and better understanding of the research question. The mixed method approach was used to determine if adding technology into our reading block could improve student word decoding on the decoding inventory in general education second grade students.

The quantitative portion of the study was the Informal Decoding Inventory that was administered and documented three times throughout the first trimester/ first part of the second trimester to assess student growth and subsequently the effectiveness of the technology interventions. The Informal Decoding Inventory is administered in our building to students in

grades first through third as another data point for us to look at and determine what type of intervention our readers need. The Informal Decoding Inventory is administered at the beginning of the school year and periodically throughout the year using the screener as an assessment to see student growth and to ensure that they are getting the correct instruction and intervention to help them become more fluent accurate readers. The test consists of word list that have different skills. There are two sections of the test but for lower elementary the focus is on the first part of the test only. The second part assesses skills that are not taught nor expected in the second grade level. However if a parent or the researcher is curious as to where a student really is or the skill they need to be working on the researcher can do the second part of the test. It starts with reading short vowel words then goes through the following; consonants blends and digraphs, r-controlled vowel patterns, vowel- consonant-e, vowel teams. Each section has twenty words that follow the different sound, spelling patterns. The words are split into two word parts per section; real words and nonsense words. To move from one line to another student need to read at least five words correct. If they do not get five words correct the researcher does not move on unless the researcher feels as though there is reason to keep going. The researcher uses their own judgement along with other reading scores and knowledge of the student to know if there is reason to move forward or not. For example one student spends twelve minutes on the first five words and has low reading scores, this student is not benefiting from the test (due to stress) and the researcher knows base on other assessments that the students will be unable to pass the rest of the test. Giving the test throughout the year is given the same way, with the same words. The students are also assessed in the same format to ensure students are not thrown off by the way the test is given.

After each assessment the researcher will look to see if the students have gained knowledge, stayed the same, scored lower. If a student scores lower the researcher look at their day and re-test them just to make sure they weren't having an off day. If they do test lower again then the researcher needs to really look into factors and determine a plan of action on what to do with the student to bring their scores back up. When looking at all the students' scores the researcher is really looking for growth, growth from one section to another or even smaller growth of being able to complete a few more words in the sections. While small growth is not huge it's important to remember that this growth is important and needs to be celebrated with the struggling reader. Looking at students who have the same scores is also used to determine intervention groups during individualized educational time (i.e. time). This is an intervention group that meets four times weekly for 15-20 minutes per time. Students will use the Walpole intervention for the first part of the year and then keep using it unless the interventions do not match the needs; at this point the students will get switched over and will use the 95% intervention. The data in combination with our other reading assessments (FAST, STAR, MAP) to look at students who struggle in more than one area and look to see if teachers are doing everything they can for them. They ask ourselves questions like; are the interventions working? Would the student benefit from an out of the classroom intervention such as title? Do the students have enough data points to talk with the AEA about special services? The researcher focuses on the effectiveness of the intervention, if the student benefit from an out of the classroom intervention, and data points to review with other special services. Researchers want to ensure that everything is being done in the classroom before looking at out of the classroom services.

The qualitative portion of the study involved the researcher utilizing a checklist to record data regarding students' scores throughout the year. This process as soon as the first assessment is given. There are added columns for the other reading assessments given to look across the board to see how each student does as a rounded reader. Throughout the reflection period, the researcher addressed and documented the following questions and concerns:

- What was the behavior of the students?
- Did the student attend to the task?
- Was the student in attendance that day?
- Did the interventions work?

The entire data collection process took place from August 2017 to November 2017. However it will continue throughout the entire school year ending in May of 2018. The first Informal Decoding Inventory test was administered in August 2017 and then again in October 2017 and finally in November 2017. Following the October screener the second grade students were introduced to FrontRow which is a computer program/ iPad app that works with students on their own specific needs. It determines where they are based on a few beginning test. Students were also introduced to some apps where they can listen to stories and work on phonics skills like spelling patterns (Epic, AR reading). The goal was to see if adding these technologies in the student's day along with their interventions with the teacher would help to bring faster growth within the students in being able to read the words on the Informal Decoding Inventory.

Data Analysis:

A minimal amount of researcher bias was included during the data collection and intervention period of the research even though the researcher was the teacher of the students

that received the interventions and introduced the reading apps. The researcher/ teacher was only there for the first screening and then left on maternity leave, so the long term sub did the second and third screeners with the assistance of our lead teacher. The school district goals and the literacy goals of the elementary building support the belief that interventions can improve literacy skills on all state wide assessments. The researchers strong interest in word recognition, the support from the title 1 teacher, lead teacher, and interventionist, along with elementary building staff, and the hypothesis that adding technology interventions does improve students Informal Decoding Inventory scores played an important role in the activities that were planned during the intervention period.

Despite the minimal amount of researcher bias, specific measures were implemented to provide quantitative and qualitative unbiased data. Collecting both quantitative and qualitative data contributed to the understanding and awareness about the benefits that technology interventions plays in increasing word recognition in the Informal Decoding Inventory and improving reading scores in general.

Quantitative Data Analysis.

The quantitative data collected through three different screener periods provided scores for a variety of literacy skills that are tested throughout the year; the main focus is the Informal Decoding Inventory but also included are other reading assessments that students were given that also have a focus on word recognition and reading skills. The quantitative data collected August through November period provided scores for word recognition in on the Informal Decoding Inventory.

Table 1:
Word Segmenting

Student	Informal Decoding Inventory- August	Informal Decoding Inventory- October	Informal Decoding Inventory- November	FAST-Fall screener Goal 58WPM	MAP Reading Fall Screener Goal 174	STAR Reading Fall Screener Grade Equivalence
1	Short Vowels- fail	Short Vowels- fail	Short Vowels- fail	4	151	0.7
2	Short Vowels	Consonants and Blends	Consonants and Blends	10	154	1
3	Short Vowels- fail	Short Vowels	Consonants and Blends- fail	8	159	NA
4	Consonants and Blends- fail	r-controlled vowel patterns- fail	Vowel Teams Pass	14	149	1
5	Consonants and Blends- fail	Consonants and Blends- fail	Consonants and Blends- fail	50	173	1.4
6	Consonants and Blends- fail	Consonants and Blends	Consonants and Blends	11	162	1.5
7	Consonants and Blends	Vowel Teams Pass	Vowel Teams Pass	34	178	2.1
8	Consonants and Blends	Consonants and Blends	Vowel consonant e- fail	77	177	1.7
9	Consonants and Blends	Vowel consonant e- fail	Vowel consonant e- fail	52	178	1.7
10	r-controlled vowel patterns	Vowel consonant e- fail	r-controlled vowel patterns	57	167	2.4
11	r-controlled vowel patterns	Vowel Teams Pass	Vowel Teams Pass	67	194	2
12	Vowel-Consonant e-fail	Vowel consonant e	Vowel Teams Pass	70	174	2
13	Vowel Teams pass	Vowel Teams Pass	Vowel Teams Pass	91	182	.7
14	Vowel Teams pass	Vowel Teams Pass	Vowel Teams Pass	61	185	2.2
15	Vowel Teams pass	Vowel Teams Pass	Vowel Teams Pass	82	190	2.7

16	Vowel Teams pass	Vowel Teams Pass	Vowel Teams Pass	192	213	5
17	Vowel Teams pass	Vowel Teams Pass	Vowel Teams Pass	85	199	2.4
18	Vowel Teams pass	Vowel Teams Pass	Vowel Teams Pass	63	189	2.5
19	Vowel Teams pass	Vowel Teams Pass	Vowel Teams Pass	89	195	3.7

The initial Informal Decoding Inventory scores from the August screening period revealed that 37% of the students were at grade level or above in word recognition. It also showed that 47% were below grade level expectations on the screener and 16% were slightly below grade level. This number indicates that word segmenting skills are above average. The other data is comparative to the first data points as well, which helps to make decisions about where students really are in terms of their reading skills.

The quantitative data from August to October revealed that 47% of the students made some amount of growth between the two months. While some grew into another section of the test others only grew by one line in the previous section, but growth is growth.

When the researcher looked at the data from October to November it revealed that 31% showed some amount of growth. When looking at the data August to November it revealed that 47% of students showed growth from the first screening period to the third screening period.

Student 1, who showed no growth in the informal decoding inventory receives individual special education and speech and language instruction.

Student 5 maintained the same informal decoding I inventory score from August to the November screening period. This score may reflect the qualitative data that reveals the student

was off task, tired, and inattentive during the intervention period. This student also has a record of poor attendance.

Students 13 through 19 didn't show any growth on the informal decoding inventory as they already had passed it the first screening period and continued to pass it throughout the other screeners. These students did not receive teacher based intervention but did take part in the technology based interventions. These students worked at a higher level based on their own scores.

Student 4 and student 7 showed the most improvement between the August through November screening periods. It is obvious to the researcher that this intervention was successful with students with various attention levels.

Qualitative Data Analysis

Qualitative data was observed weekly throughout the intervention period using the FAST screener progress monitoring for students 1-10. All students were monitored online from their technology interventions as well. Qualitative data was primarily observed, however, informal discussions with students and groups of students also provided valuable data about whether or not interventions were working or not.

Students 1-12 were placed in teacher based intervention groups that met four times a week. The teachers used the Walpole intervention system based on where students scored on the Informal Decoding Screener. These interventions started directly after the first screening period. After the second screening period in October all students were introduced to the technology based intervention instruction.

Below is a weekly progress monitoring chart for students 1-10. The chart is based on progress monitoring through the FAST screener using the CBMR . The researcher didn't have all data

points for students due to transition time between the regular classroom teacher and the sub starting time.

Student	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12	Week 13
1	5	4	7	9	11	6	4	11	5	4	7	10	10
2	14	19	22	7	21	16	24	21	16	24	19	14	35
3	11	7	9	13	14	11	13	14	11	13	9	13	17
4	-	-	-	-	-	-	-	-	-	-	-	-	-
5											87	94	67
6	9	14	19	14	24	17	21	24	17	21	23	13	16
7											63	49	50
8											44	44	59
9											74	89	80
10											66	68	56

Discussion

Summary of Major Findings

Throughout this study, the findings concluded that based on the amount of exposure the students had with word decoding/ reading interventions, their informal decoding inventory scores increased. The data shows that the interventions had a positive effect on the student's November informal decoding inventory scores. The greatest area of improvement for student growth was seen with students who received both teacher based interventions along with technology based interventions. The study also found that students who were actively engaged with the technology based intervention maintained their scores and continued to grow. As these interventions continue the researcher will continue to look at how these intervention effects the other reading assessments.

Limitations of Study

The limitations in the research included administering the same word list in the Informal Decoding Inventory each screening period; both the same words and in the same order. The

students' teacher was also only there for the first screening period before she went on maternity leave, which could also play into the student's growth. The researcher must also take into consideration other factors that may influence the findings of the research project. Natural maturation combined with additional classroom activities and lessons, which specifically focused on word decoding and other phonics lesson, may have also affected the results of this study.

Further Study

Implications for future research suggest that more information about word decoding should be considered. More research needs to be conducted on other reading assessments to find beneficial interventions that can be administered using technology to improve the Informal Decoding Inventory screener along with the additional reading assessments.

Conclusion

The findings compiled from the collected data suggest that adding technology based interventions can have a positive impact on student's Informal Decoding Inventory scores. Both the qualitative and quantitative data suggest that using interventions, both teacher and technology based, are beneficial for increasing word decoding scores on the Informal Decoding Inventory assessment. However more data points will be needed to see the trends and know what type of impacts the intervention has on the students screening scores.

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