Original Paper

Pedagogical Efficacy of Connections-OG in 3-D®: A Reading Program Based on the Science of Reading

Carol Klages[1*] & Mary-Margaret Scholtens[2]

[1] University of Houston-Victoria, Victoria, Texas, United States

[2] Kelly Fowler, Cherry Frierson, The Apple Group, Jonesboro, Arkansas, United States

[*] Carol Klages, University of Houston-Victoria, 3007 N. Ben Wilson Street, Victoria, Texas, 77901, United States

Abstract

No one disputes the importance of reading to life, career, and success. What is under debate is how to teach one to read. This research investigation analyzes the pedagogical efficacy of the Connections-OG in 3-D® reading program. Connections: OG in 3D® is a structured literacy curriculum that systematically teaches the entire structure of the English language. Each lesson provides direct, explicit instruction in the five components of reading, as outlined in the NRP Report (2000). Five elementary schools, in Arkansas and Missouri, used this program with fidelity to teach all their early elementary students how to read. The application of the Connections: OG in 3D® began in 2017 and continues to present day. Each school conducted its own assessments to determine student reading success. These assessments were collected, analyzed, and reviewed by sources outside the school district and Connections: OG in 3D®. The results of utilizing a structured literacy program based on the science of teaching reading is shared.

1. Introduction

The cost of illiteracy and reading difficulties in American society is widely accepted and largely incontrovertible. Being an illiterate adult in the United States can be costly. According to the 2019 National Assessment of Educational Progress (NAEP) or better known as the Nation's Report Card, 35% of American fourth graders read at a proficient level and 34% of American eighth graders read at a proficient level. Research compiled for the National Conference of State Legislatures (2020) third graders who are not reading on grade level are most likely to eventually drop out of school. Illiteracy has a monetary influence on people as well. American employers spend $125.9 billion dollars to train

potential employees in the areas of remedial reading, writing, and mathematic skills (ProLiteracy, 2020). Educators must act on scientific research in order to prevent reading failures. Illiteracy stems from lack of appropriate reading instruction in the early school years. Since reading is not a natural process, literacy must be taught through the lens of the science of reading. Literacy teaching must encompass all the elements and modalities in one comprehensive, research-based program. One such program is from The Apple Group Connections: OG in 3D® (Frierson & Scholtens, 2014 (Connections: OG in 3D®)) science-based reading. Connections: OG in 3D® is an efficacious methodology for addressing reading difficulties with proven reading results.

Multiple modalities have been developed to address the process of teaching children to read and address reading difficulties. The most successful, however, are predicated on science-based reading instruction and evidence-based approaches. According to The National Reading Panel (NRP) Report (National Institute of Child Health and Human Development (NICHD), 2000) states that effective reading instruction focuses on five critical areas: phonemic awareness, phonics, fluency, vocabulary, and comprehension. While many schools may use different approaches to these five components, the NRP (2000) determined that systematic and explicit instruction is best. Teaching reading effectively, especially to students who are struggling, requires considerable knowledge and skill. A valuable approach for teaching children to read is that of the Connections: OG in 3D® program. This program has produced significant reading results for years with recent data over the last three years in grades kindergarten, first and second thus, making it a significant research-based literacy program.

2. Review of Literature

2.1 The Science of Reading

While the approaches to teaching reading may vary, the foundation of those approaches cannot. The NRP Report made it very clear that effective reading instruction must address five specific components that are taught systematically and explicitly: phonemic awareness, phonics, fluency, vocabulary, and comprehension (NICHD, 2000). The first component is phonemic awareness. Phonemic awareness is significant to learning an alphabetic language (Wagner, Torgesen, & Rashotte, 1994). Phonemic awareness is understanding that spoken words consist of separate parts of sound that can be blended together to make words. By measuring the degree to which children develop phonemic awareness, researchers can identify who would learn to read with ease and who would have difficulty (Share, Jorm, Maclean, & Matthews, 1984). Phonemic awareness plays a significant role in learning to read.

The second component is phonics. Appropriate phonics instruction supports the skills children need to read and spell words automatically. Jeanne Chall (1967) began important research that supports the systematic phonics instruction. Phonics is more than mastery of simple relationships between letters and sounds. It includes lessons in word structure and origin (Moats, 2007). Phonics instruction promotes the relationship between graphemes, which are letters or letter combinations and phonemes which are individual speech sounds. A strong literacy program is not limited to phonics instruction.

11

The third component in effective teaching of reading is fluency. Fluency instruction should be built on understanding, "Reading fluency that supports comprehension is built on automaticity in word recognition, accurate word reading, prosody, and expression" (Moats & Tolman, 2009). According to Kilpatrick (2019), "The elusive key to reading fluency is sight word vocabulary". Without a sight word vocabulary, reading is effortful and often incorrect. Fluency is a product of efficient reading instruction.

The fourth component in efficient reading instruction is vocabulary. Vocabulary is a set of words children must know to communicate with others. Vocabulary encompasses four types: listening, speaking, reading, and writing (Learning Point, 2004). Two instructional strategies that improve reading comprehension are based on ongoing, long-term vocabulary instruction (Beck, Perfetti, & McKeown, 1982) and teaching vocabulary before making a reading assignment (Brett, Rothlein, & Hurley, 1996; Wixson, 1986). Scarborough (2001) lists breadth and depth as important during vocabulary study. Breadth affects reading comprehension while depth affects fluency (Tannenbaum, Torgeson, & Wagner, 2006). Vocabulary knowledge is vital to becoming a successful reader.

The fifth component of effective reading instruction is comprehension. Comprehension is understanding what one reads. The content of comprehension is the sum of its parts. Gough and Tunmer (1986) depicted reading comprehension as the sum or word recognition (or decoding), multiplied by language comprehension. Skills upon which comprehension is dependent should be taught. Word reading, vocabulary, syntax, background knowledge, inferencing, and attention are skills that are important for making sense of text (Kilpatrick, 2015). Reading comprehension relies on many covert mental activities. Again, all of the components of effective reading instruction must be taught in a systematic, explicit manner (NRP, 2000). These specific guidelines can be a challenge but are necessary for successful reading instruction.

Systematic instruction is done in a planned, logical progressive sequence (Learning Point Associates, 2004). Certain sounds that are easier to learn should be taught before those that are more difficult. The lesson objectives are clear and specific in terms of what students must be able to do. According to the International Dyslexia Association (2020), the organization of what is taught to students should follow the logical order of the language. Carefully created tasks give students learning opportunities to apply what they have been taught. Any assessments are designed in a timely manner to check skill attainment as well as the application of new skills and their retention over time as students work independently.

Explicit instruction requires that the teacher state clearly what is being taught. The student does not have to guess what he/she is supposed to know from the lesson. Explicit instruction requires teachers to model how a skill is to be used. Carefully created tasks give students learning opportunities to apply what they have been taught (International Dyslexia Association, 2020). In this approach, the student's attention is focused on what is important to know or do. The Connections: OG in 3D® reading program is based on the five components of effective reading instruction that is systematically and explicitly delivered.

3. Connections: OG in 3-D®

Connections: OG in 3D® is a structured literacy curriculum that systematically teaches the entire structure of the English language. Each lesson provides direct, explicit instruction in the five components of reading, as outlined in the NRP Report (2000). Lessons are cumulative and follow a logical order. The scope and sequence present the alphabetic principle in order of frequency of use, from simplest to most complex. Concepts are taught from concrete to abstract, through hands-on lessons with 3-D materials. The 3-D materials evolved from the multisensory approach of Orton-Gillingham (Gillingham & Stillman, 1960, 1997) for teaching reading. Students can "hold" and manipulate sounds in their hands with 3-D objects. An example of a 3-D object used in this literacy program would be an actual apple. The student would hold this apple, smell the apple, and even taste the apple, if appropriate, in order to learn the short vowel sound of /a/. Connections: OG in 3D® follows the principles and content of a multisensory structured language approach. Connections: OG in 3D® stands apart from other Orton-Gillingham (Gillingham & Stillman, 1960, 1997) (OG) because it incorporates phonemic objects. By holding the object, which represents the sound he/she is learning, the student can actually "feel" the sound, helping to make more connections to the brain in order to remember that sound. In addition to visual, auditory, tactile, and kinesthetic teaching, Connections: OG in 3D® also incorporates teaching sounds by smell and taste, senses that are often overlooked in multisensory programs.

Connections: OG in 3D® teaches students to attend to sound, spelling, meaning, and etymology. In addition to phoneme-grapheme correspondence and orthographic mapping, students become aware that the English language is morphophonemic, as layers of etymology and morphology are added.

Application of sound to symbol knowledge, spelling rules and patterns, grammar, comprehension, and fluency are practiced using nonsense words, real words, phrases, sentences, and connected text. 100% decodable, personalized readers provide decoding practice. Vocabulary (including multiple meanings and figures of speech) is learned by developing semantic networks or ideas and relationships.

To ensure automaticity, frequent distributive practice and checkpoints for mastery are built into each lesson. When decoding becomes automatic, students are able to use their cognitive energy for higher level comprehension. Students learn syntax and semantics using material they are actually able to decode. Connections: OG in 3D® gets its name from the connectivity of the neural pathways from orthography, phonology, and semantics, following the research of Seidenberg (2017). The elements of effective reading instruction are "connected" and work together to produce readers.

4. Purpose of Investigation

The purpose of this investigation is to identify student literacy growth over an academic school year calendar using the science-based, Connections: OG in 3D® literacy program in grades kindergarten, first grade, and second grade in Arkansas elementary schools and one Missouri elementary school.

5. Research Design

For the purpose of this investigation, a quasi-experimental (Cook & Campbell, 1979), one group pretest-posttest design was used. Rather than have some students not receive reading instruction in the classroom, no randomized control group was used. Every student in the classroom was taught using the same Connections: OG in 3D® program which was the treatment. Each teacher had completed Connections: OG in 3D® training and signed a statement as to the fidelity of the program. For these reasons, the variable, Connections: OG in 3D® training, was measured as it naturally occurred in the classroom setting. The pretest was considered to be the first time the students were assessed for a reading skill. The posttest was each time after the initial test that students were assessed. Basically, the beginning of the school year was the pretest, and every time after was a posttest.

Throughout the school year as reading instruction continued, each school used its own form of reading assessment based upon individual school district requirements. The data reported for this investigation was gathered by the schools and sent to the investigators for analysis.

6. Participants

The participants in this investigation were five elementary schools in five different districts in the state of Arkansas as well as one elementary school in the state of Missouri. Each school district had only one elementary school with a differing number of grade levels involved in the Connections: OG in 3D® program because only one elementary school was needed in that district or the elementary school is divided into other campuses, but still classified as an elementary school. Each teacher of kindergarten, first grade, and/or second grade completed the required Connections: OG in 3D® training in order to use the program with their students during the school year and/or future school years. The participant teachers were all certified educators in the states of Arkansas and Missouri who were required by their school district to participate in the training for use in the coming school year.

South Side Bee Branch Elementary School is a kindergarten through sixth grade campus. On their campus, 60% of the students are considered from low-income homes. The student to teacher ratio is 13:1. The class size is 15 students. The school has an overall campus rating of C according to state data. For the investigation, kindergarten through second grade used the Connections: OG in 3D® program.

Blytheville Primary School is a kindergarten to second grade campus. On their campus, 82% of the students are considered from low-income homes. The student to teacher ratio 14:1. The average class size is 16 students. The school has an overall rating of D according to state data.

Mountain Home Kindergarten is a kindergarten only campus. On their campus, 58% of the students are considered from low-income homes. The student to teacher ratio is 13:1. The average class size 17 students. The school has an overall campus rating of B according to state data.

Nelson Wilks Herron Elementary is a first and second grade campus in the Mountain Home School District. On their campus, 57% of the students are considered from low-income homes. The student to

14

teacher ratio is 16:1. The average class size is 20 students. The school has an overall campus rating of B according to state data.

Park Elementary School is a kindergarten to second grade campus in the Corning School District. On their campus, 75% of the students are considered from low-income homes. The student to teacher ratio is 12:1. The average class size of 12. The school has an overall campus rating of B according to state data.

Southwest Elementary School in Dexter, Missouri is the only school in this investigation from Missouri. The school is a Pre-Kindergarten to second grade campus. On their campus, 58% of the students are considered from low-income homes. The student to teacher ratio is 13:1. The average class size is 13. The campus has an accredited rating.

7. Context of the Investigation

As researchers seek to gather and address research in how to best teach reading to students, it is important for those involved to establish a snapshot of a literacy program's ability to prepare readers. Evidence must be an essential part of teaching. As such, the Connections: OG in 3D® program must assess itself on a regular basis to identify student success as well as those who are not as successful. What matters is the modality of the pedagogical approach taken in addressing learning to read. Science and evidence-based methods are quantitatively superior to those not predicated on consistently replicable approaches. A successful literacy program can only be purposeful if it is preparing students to be readers.

8. Data Sources

For this investigation, the Arkansas elementary schools, South Side Bee Branch, Mountain Home Kindergarten and Nelson Wilks Herron Elementary, involved collected data on their students by using the DIBELS® reading assessment. DIBELS® is an acronym for Dynamic Indicator of Basic Early Literacy Skills. It is a short assessment tool to monitor student success with early literacy skills and reading skills. The use of DIBELS® can identify if a child is going to struggle with learning to read (Center on Teaching and Learning (n.d.)). In order to determine that Connections: OG in 3D® represents a scientific pathway to teaching students how to read, it is necessary to analyze objective data from whole-class applications in school districts which have adopted Connections: OG in 3D®.

Blytheville Elementary school assessed their students using the IStation (n.d.) reading assessment. This assessment tool measures reading ability as well as identifies reading deficiencies based on given student responses. Skills can be measured across different grade levels, kindergarten through eighth grade as it is computer-adaptive in nature.

Park Elementary school used the STAR assessment tool. This tool was developed by ThoughtCo. It is an online-based reading assessment program that uses the cloze reading tool as well as traditional comprehension reading passages to determine student reading progress. This tool can be used for grades kindergarten to twelfth that gives teachers immediate, individual student data to inform instruction. It is

an assessment tool as well as a diagnostic and monitoring tool for teachers to see if there is student reading growth (Meador, 2020).

Southwest Elementary from Missouri used the AimswebPlus (n.d.) assessment tool by the Pearson Company to monitor student progress in reading and mathematics. For this investigation, only the reading reports were used. The students take the assessment primarily online and the results are reported in real time. Common Core Standards and state standards are aligned within the assessment process. The data is reported three times a year. For this investigation, only the fall or beginning of the school year reports and the spring or end of the school year reports were used. The results are reported in a Figure 1, Figure 2, and Figure 3 risk level. Figure 1 is a low risk for reading failure. Figure 2 is a moderate risk for reading failure, and Figure 3 is a high risk for reading failure.

9. Data Results

South Side Bee Branch Elementary School participated in the Connections: OG in 3D® program in grades Kindergarten through second grade. The year they used the program was 2018-2019 school year. The 2019-2020 results have not been completed as yet. The results were assessed with the DIBELS assessment tool.

Students in the kindergarten class of 2018-2019 were assessed eighteen times throughout the school year. There was no assessment report that indicated any negative growth. At every assessment period the growth at least doubled. At the end of the school year, eighty-three percent of the class was reading on grade level and seventeen percent below grade level. These results were better than the state average.

The first-grade classroom experienced similar results. This group was assessed twenty times throughout the school year. At the end of the year, seventy percent of the students were reading on grade level and thirty percent were below grade level. These results were better than the state average.

The second-grade classroom was assessed fifteen times over the course of the 2018-2019 school year. Their results were similar to those of the previous two grade levels. At the end of the school year, eighty percent of the students were reading on grade level and twenty percent were below grade level. These results were better than the state average.

Due to the success of the early elementary grades at South Side Bee Branch elementary school, the fourth through sixth grades decided to add the Connections: OG in 3D® program in the 2019-2020 school year. The end of year reading scores prior to Connections: OG in 3D® were 40% of the fourth -grade reading at or above grade level. In the fifth grade, 39% of students were reading at or above grade level. At the end of the school year for the sixth-grade students, 33% were reading at or above grade level.

Once the Connections: OG in 3D® program was added the following school year, the middle of the year results changed: 52% of fourth grade, 71% of fifth grade and 42% of sixth grade were reading at or above grade level.

South Side Bee Branch

4th Grade Class - 30% Increase of Growth
5th Grade Class - 82% Increase of Growth
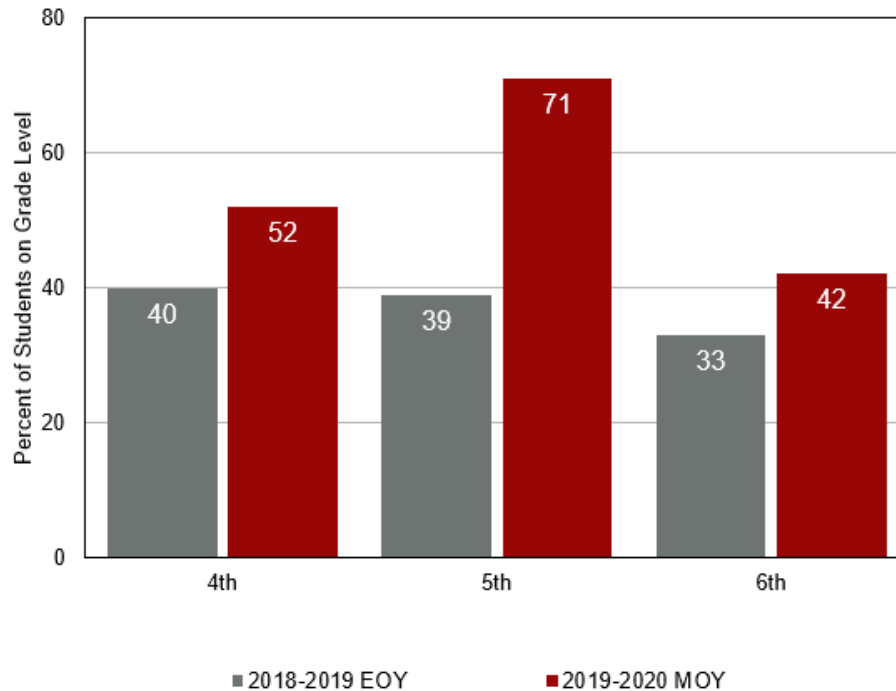6th Grade Class - 27% Increase of Growth

Figure 1. South Side Bee Branch Reading Growth

Mountain Home kindergarten class began using the Connections: OG in 3D® in the 2018-2019 school year. Prior to use, 2017-2018, 46% of their kindergarten students were reading at or above grade level. Once Connections: OG in 3D® began in the following year, 84% of the kindergarten students were reading at or above grade level.

Because the kindergarten class of 2018-2019 was successful with the Connections: OG in 3D® program, the first grade was added to the 2019-2020 school year. In the 2018-2019 school year, 46% of the first graders were reading at or above grade level. In the following school year, to date February 2020, 67% of the first graders are reading at or above grade level.

Mountain Home, AR

Kindergarten

2017-2018 - 240 total students
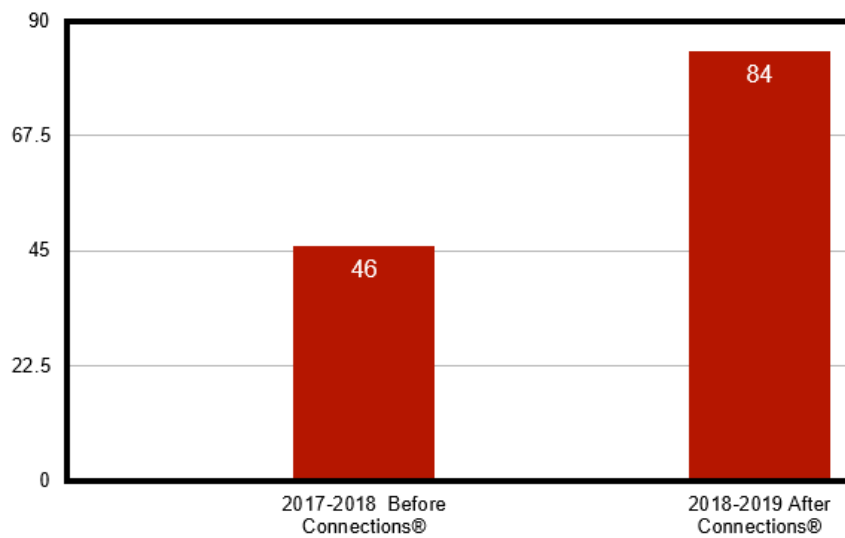2018-2019 - 257 total students

Figure 2. Mountain Home Reading Growth Kindergarten

Mountain Home, AR

First Grade
267 Total Students in 2018
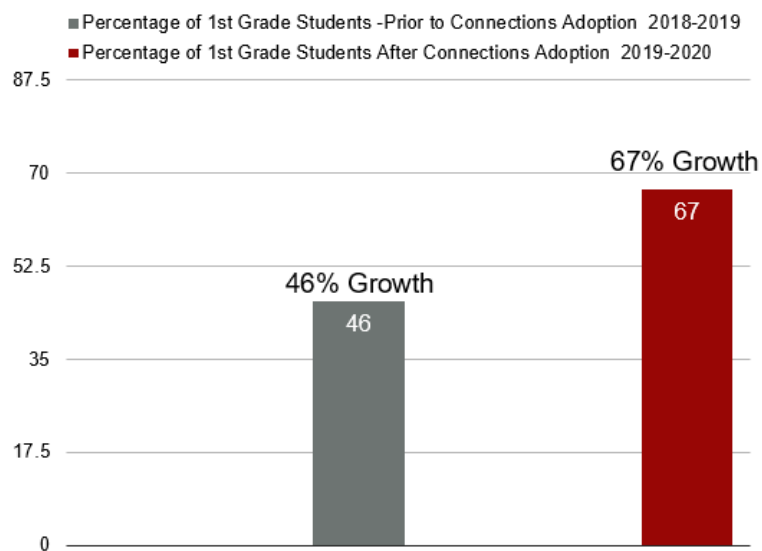242 Total Students in 2019

Figure 3. Mountain Home Reading Growth First Grade

18

Southwest Elementary school in Missouri started the Connections: OG in 3D® program with second grade students in the school year 2018-2019. Their entire school year was reported. In the fall, 55% of the students were at Figure 1, 28% of the students were reported at Figure 2, and 17% of the students were reported at Figure 3.

In the spring, 84% of the students were reported at Figure 1, 5% were reported at Figure 2, and 11% were reported at Figure 3. At the end of the academic year, Tier1 experienced 60% growth which means less students are at risk for reading failure. Figures 2 and 3 also experienced positive changes. In the fall 45% of the students were either at moderate for high risk for reading failure. At the end of the academic year, only 16% were at moderate or high risk for reading failure therefore, 166% positive change for the those with reading struggles.

Because the second-grade class showed such incredible reading growth in the previous school year, kindergarten and first grade were added to those students receiving reading with the Connections: OG in 3D® program in the 2019-2020 school year. As the school year is still in progress at the time of this article, the results are for the fall, or beginning of the school year and the winter break, which is in December. The spring results will be added to this article as they are available. The first results to share are for the kindergarten group. In Figure 1, 25% of the students are at low risk of reading failure. For Figure 2, 18% are at a moderate risk for reading failure and Figure 3, the highest risk of reading failure was 57% of the class.

The winter assessment results identified 42% of the class was now at a low risk of reading failure. Figure 2 had 30% at moderate risk of reading failure and Figure 3, the highest risk of reading failure was now 28%. The positive growth rate for those at Figure 1 was now 42% which is a 63% change from the fall assessment. Those students in Figures 2 and 3 with the highest risks of reading failure where now 58% change. As such, Figures 2 and 3 showed positive growth in reading by 34% over a few months period of time.

The first-grade class also showed positive results. Again, these results are for the fall and winter assessment period of the 2019-2020 school year. In the fall assessment period, 48% of the students were identified as Figure 1. Students identified as Figure 2 for the fall semester totaled 12%, and 40% students were recorded as Figure 3.

The winter assessment results are as follows: 55% at Figure 1, 14% at Figure 2, and 31% identified at Figure 3. For the Figure 1 students, that is an 11% increase in the number of students who are now considered to be at low risk for reading failure which means some students moved from either the second or third tiers which are identified to be at a moderate or his risk of reading failure. Figures 2 and 3 also showed positive growth. Students moved from Figure 3, which is at a high risk for reading failure into the Figure 2 category which is moderate risk.

The second grade at Southwest Elementary continued their use of the Connections: OG in 3D® program. Their results for the 2019-2020 school year are positive again. In the fall assessment report, 59% of the students were identified Figure 1. For Figure 2, 21% of the second graders were at a moderate risk for

19

reading failure. In Figure 3, 20% of the students were at high risk for reading failure. In December 2019, the winter assessments were given. 69% of the students were assessed at Figure 1. 19% of the students were identified at Figure 2, and finally, 12% of the students were identified at Figure 3. For Figure 1, that is 16% positive growth in the number of students who are now at low risk for reading failure. For Figures 2 and 3, the growth was 32% who moved out of the higher risk tiers.

Kindergarten 2019-2020
Southwest Elementary
Dexter, MO

	Fall 2019	Winter 2019	Increase	Decrease
Tier One	41 Students	67 Students	63%	
Tier Two	30 Students	48 Students	60%	
Tier Three	95 Students	45 Students		52%
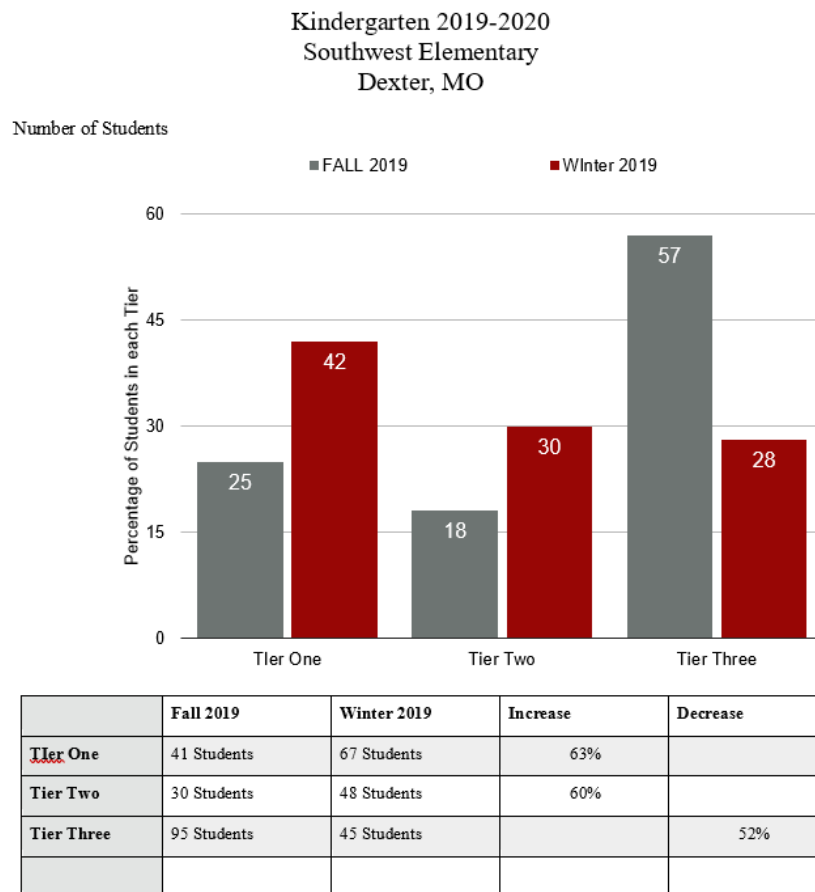
Figure 4. Southwest Elementary Reading Growth Kindergarten

First Grade 2019-2020
Southwest Elementary
Dexter, MO

Number of Students

■ FALL 2019   ■ WInter 2019

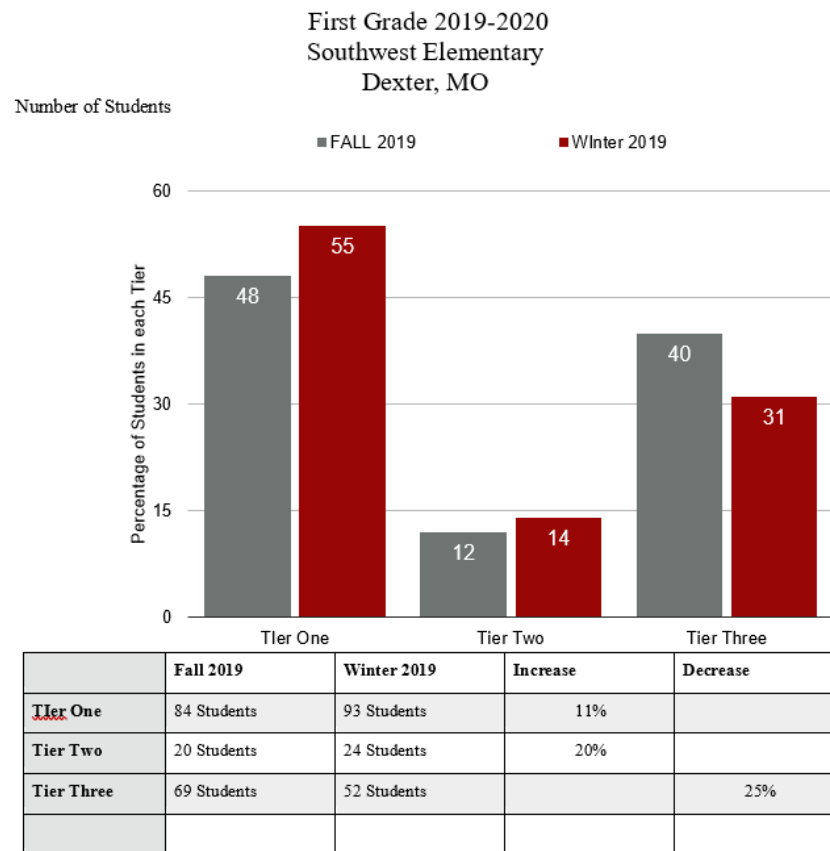|	Fall 2019	Winter 2019	Increase	Decrease
TIer One	84 Students	93 Students	11%	
Tier Two	20 Students	24 Students	20%	
Tier Three	69 Students	52 Students		25%

Figure 5. Southwest Elementary Reading Growth First Grade
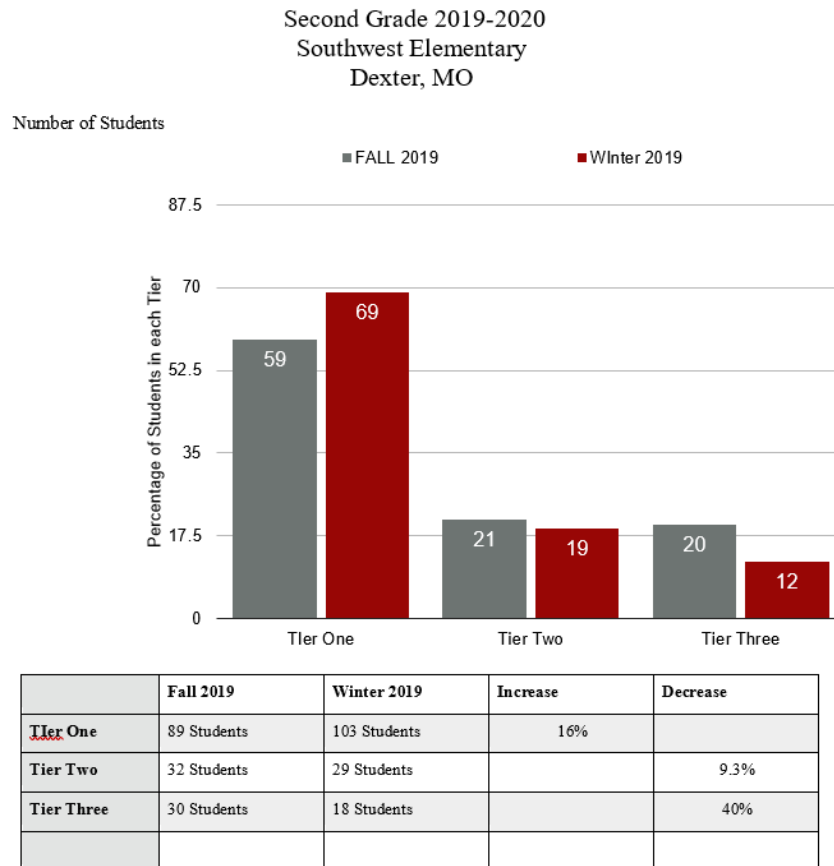
Figure 6. Southwest Elementary Reading Growth Second Grade

	Fall 2019	Winter 2019	Increase	Decrease
Tier One	89 Students	103 Students	16%	
Tier Two	32 Students	29 Students		9.3%
Tier Three	30 Students	18 Students		40%

The kindergarten and second grade classes at Blytheville elementary all participated in the Connections: OG in 3D® reading program in school years 2018-2019 and 2019-2020. Kindergarten was assessed in letter knowledge and phonemic awareness (two important aspects of learning to read) using the IStation reading assessment. The second-grade class was assessed in spelling using the IStation reading assessment. Beginning in September to February, every month of the 2018-2019 and 2019-2020 school years were assessed except the month of October for the kindergarten class.
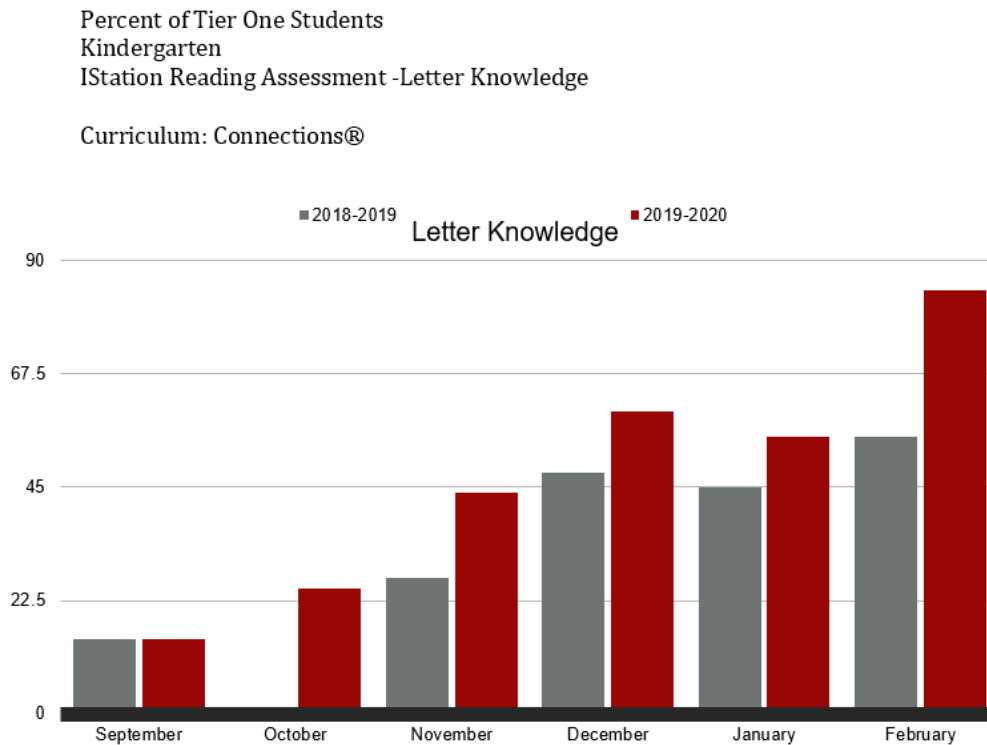
Percent of Tier One Students
Kindergarten
IStation Reading Assessment -Letter Knowledge

Curriculum: Connections®

Figure 7. Blytheville Elementary Reading Growth Kindergarten

In the 2018-2019 school year the kindergarten class saw 20% of the students mastering letter knowledge. In November, 22.5% mastered it. December saw 45% of the students mastering letter knowledge. January saw a downturn to 40%, but February was back up to 45%.

When the 2018-2019 school is compared to the next school year 2019-2020, the positive growth becomes more evident. In September, 20% mastered the letter knowledge needed to learn to read. November saw 45% of the students mastering that knowledge. In December the growth continued with 50% of the students able to identify letters needed for reading. Again, in January a dip occurred down to 45%, but it rose in February to 68%.

The kindergarten class was assessed in phonemic awareness in 2018-2019 and 2019-2020 school years. In the 2018-2019 school year, the results are as follows: 28% of the students met the criteria for phonemic awareness needed in order to read. Again, in October no testing was done. November saw assessment remain the same in terms of percentage points. In December and January, 40% of the students possessed phonemic awareness skills. In February, that percentage rose to 45%. No negative results were reported in terms of phonemic awareness skills.

In the 2019-2020 school year the kindergarten students had to demonstrate their phonemic awareness skills. In September, 31% of the students demonstrated proficiency in phonemic awareness skills. In November, Phonemic awareness skills rose to 43% and again in December to 45%. In January, there was a slight drop in percentage points to 43%. In February, the percentage points rose again to 50% proficiency in phonemic awareness skills.
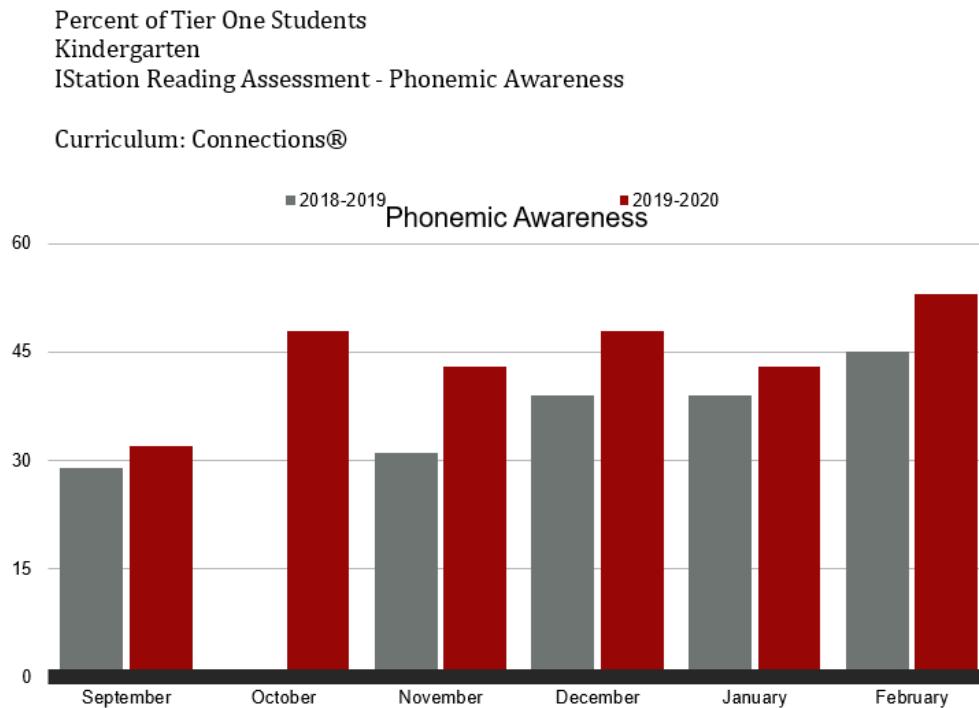
Percent of Tier One Students
Kindergarten
IStation Reading Assessment - Phonemic Awareness

Curriculum: Connections®

Figure 8. Blytheville Elementary Reading Growth Kindergarten

The Blytheville Elementary second graders were assessed in the school years 2018-2019 and 2019-2020. They were assessed on their spelling knowledge. The 2018-2019 scores are as follows: September 35%; October 40%; November 44%; December 45%; January 42%; and February 45%.

The spelling assessment for the Blytheville in the next year are as follows: September 42%, October 56%, November 46%, December 45%, January 47%, and February 47%. The second graders were assessed during the month of October unlike the kindergarten class.

Park Elementary school first and second graders (one of each class at the school) participated in the Connections: OG in 3D® program beginning in the school year 2017-2018 with the program following the students to second grade. The results show double digit growth in both school years.
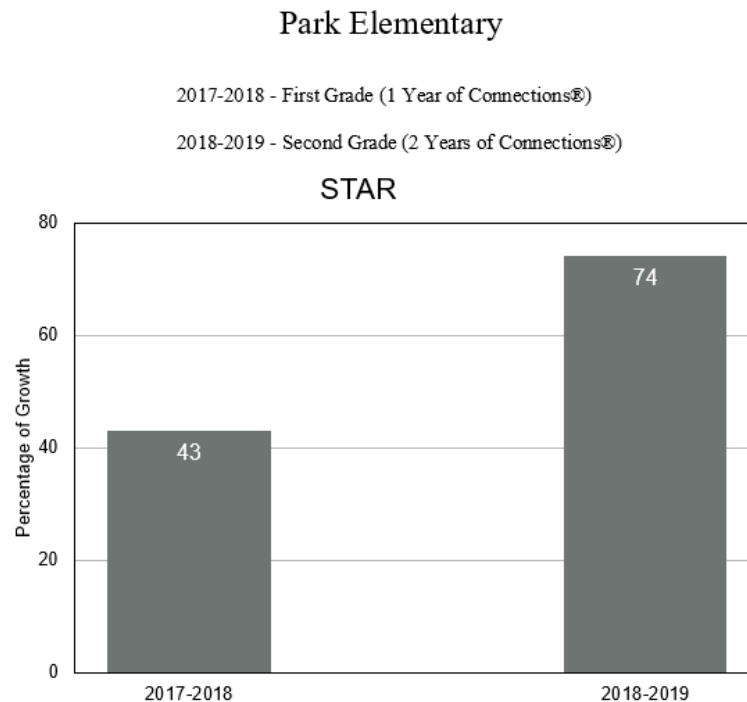
Park Elementary

2017-2018 - First Grade (1 Year of Connections®)

2018-2019 - Second Grade (2 Years of Connections®)

STAR

Figure 9. Park Elementary Reading Growth First and Second Grades

10. Limitations of the Investigation

In this investigation due to the type of design, there are several limitations that must be explored. While every teacher was trained in the Connections: OG in 3D® program and signed an agreement to use the program with fidelity, without direct, constant observation, it is difficult to prove fidelity.

Another limitation of this investigation is the difference in assessment tools used by each school. Regardless, two of the schools were in Arkansas, neither used the same type of assessment tool to record student results. While each assessment tool assesses the five necessary components of learning to read, it was not consistent in how students demonstrated their knowledge.

However, it can also be stated that the difference in assessment tools used throughout the various school districts bodes to the strength of the Connections: OG in 3D® program. Regardless of the assessment tool selected, the Connections: OG in 3D® program participants scored significant growth. Connections: OG in 3D® program is not biased toward one particular type of reading assessment tool.

While each teacher who used the Connections: OG in 3D® program was trained to do so, there is no guarantee from the schools that the people who assessed the students for the pretest and posttest were certified teachers or had sufficient training in using the assessment tool. As such, this lack of information could influence assessment tool results.

11. Discussion

Overwhelmingly, the results when using the Connections: OG in 3D® program are significant. Each individual grade level at each of the elementary schools saw reading growth from the previous school year when using the Connections: OG in 3D® reading program. The change in reading on grade level saw significant growth at each grade level for each school.

The students at Blytheville Elementary were not consistently assessed in the month of October, so that data was not provided to the investigation. For the kindergarten students, the month of January reported a slight negative dip in the scores of letter knowledge and phonemic awareness for both school years. As the students are off for almost two and a half weeks from school, they are not consistently reviewing and addressing their letter knowledge and phonemic awareness skills. The scores rebounded in the month of February and were even higher than that of the December scores.

The growth in spelling skills for the second graders from the beginning of each school year to middle of the next semester is overall positive with the exception of December to January of 2018-2019 and October to November of 2019-2020. The dip in skills from December to January of 2018-2019 could be attributed to the winter break that students have for close to two- and one-half weeks where they did not actively practice those specific skills. The dip in percentage points for the month of January 2019-2020 school year is attributed to the same reason as stated previously; winter break with the time off from school. It is noted that the scores rose in February.

The Connections: OG in 3-D® reading program supports the science of teaching reading in a systematic, direct manner. Each teacher taught the program in the same manner, with the same materials, objects, lessons, and sequencing. As the program teaches to mastery, the students may need different amounts of time to be successful, but the score results indicate positive results.

It is significant to note that regardless of the school's demographic data, students produced close to or at double digit growth in their reading on grade level scores when the Connections: OG in 3D® reading program was used to teach them to read. The score results for all students involved with learning to read via the Connections: OG in 3D® program were higher than the average state scores in both Arkansas and Missouri.

Another important element of the data results is that regardless of assessment tool used, the student growth remained positive and consistent with Connections: OG in 3D®. Evidence supports Connections: OG in 3D® does not favor a particular type of reading assessment. The results of Connections: OG in 3D® are positive and significant regardless of the school district's assessment tool choice.

12. Future Research

Research efforts are ongoing. As other school districts adopt Connections: OG in 3D®, their assessment data will be reviewed and shared. As this research effort was in progress, schools in two other states, Pennsylvania and Minnesota, have selected the Connections: OG in 3-D® program. As the demographic information in states differs as well as their reading base scores, comparing assessments from those states can provide further evidence of Connections: OG in 3D® being a science-based reading program.

13. Conclusion

The ability to read is too precious of a skill to allow any student to fail at the task. As more and more students learn to read, regardless of personal background or socio-economic level, the propensity within the education system to embrace teaching fads and unproven programs must offer a way to a more effective practice of teaching students to read on a more evidenced-based foundation. The science of reading is solid scientific research on how reading should be taught to read. The Connections: OG in 3D® program was developed on that scientific research. Student reading success has been proven based on solid effective reading practices that Connections: OG in 3D® utilizes. Based on the evidence presented, the Connections**:** OG in 3-D® reading program has significantly increased scores in multiple school districts made up of different demographics. Connections: OG in 3D® has proven that all students can learn to read.

References

Beck, I., Perfetti, C., & McKeown, M. (1982). Effects of long-term vocabulary Instruction on lexical access and reading comprehension. *Journal of Educational Psychology*, *74*(4), 506-521. https://doi.org/10.1037/0022-0663.74.4.506

Brett, A., Rothlein, L., & Hurley, M. (1996). Vocabulary acquisition from Listening to stories and explanation of target words. *Elementary School Journal*, *96*(4), 415-422. https://doi.org/10.1037/0022-0663.74.4.506

Center on Teaching and Learning. (n.d.). *UO: DIBELS Data System*. Retrieved February 10, 2020. Dibels.uoregon.edu

Chall, J. (1967). *Learning to read: The great debate*. New York: McGraw Hill.

Cook, T. D., & Campbell, D. T. (1979). Q*uasi-experimentation: design and analysis issues for field settings*. Chicago, IL: Rand McNally Publishing Company.

Frierson, C., & Scholtens, M. (2014). *Science-based reading connections: OG in 3D*. Jonesboro, AR: The Apple Group.

Gillingham, A., & Stillman, B. W. (1960). *Remedial training for children with specific disability in reading, spelling, and penmanship* (6th ed.). Cambridge, MA: Educator's Publishing Service.

Gillingham, A., & Stillman, B. W. (1997). *The Gillingham manual: Remedial training for children with specific disability in reading, writing, and penmanship* (8th ed.). Cambridge, MA: Educators Publishing Service.

Gough, P. B., & Tunmer, W. E. (1986). Decoding, reading, and reading Disability. *Remedial and Special Education*, *7*(1), 6-10. https://doi.org/10.1037/0022-0663.74.4.506

International Dyslexia Association (2020). *Effective Reading Instruction*. Retrieved February 10, 2020, from https://dyslexiaida.org/effective-reading-instruction/

IStation Reading (n.d.). *Powerful research-based assessments and instruction based on the science of reading and the Big Five*. Retrieved February 10, 2020, from https://www.istation.com/Reading

Kilpatrick, D. A. (2015). *Essentials of assessing, preventing, and overcoming reading difficulties*. Hoboken, NJ: John Wiley & Sons.

Kilpatrick, D. (2019). *Recent Advanced in Understanding Word Level Reading Problems: Implications for Instruction and Intervention*. Paper presented at the 47th Arkansas Literacy Conference, Little Rock, Arkansas. Retrieved from https://www.slideplayer.com/slide/17795239/

Learning Point Associates, (2004). *A closer look at the five essential components of effective reading instruction: A review of scientifically based reading research for teachers*. ED-01-CO-0046/0001.

Meador, D. (2020, February 11). A Comprehensive Review of the Star Reading Program. Retrieved February 29, 2020, from https://www.thoughtco.com/review-of-star-reading-3194776

Moats, L. C., & Tolman, C. (2009). *Language Essentials for Teachers of Reading And Spelling: Module 5 Getting Up to Speed: Developing Fluency* (2nd ed.). Dallas, TX: Sopris West Educational Services.

Moats, L. C. (2007). *Whole language high jinks: How to tell when "scientifically-based reading instruction" isn't*. Thomas B. Fordham Institute (ERIC Document Reproduction Service No. ED 498005).

Moats, L. C. (2017). Can prevailing approaches to reading instruction accomplish the goals of RTI? *Perspectives on Language and Literacy*, *37*(4), 21-24.

National Conference of State Legislatures. (2020). Retrieved February 10, 2020, from https://www.ncsl.org/research/education/pre-kindergarten-third-grade-literacy.aspx

National Institute of Child Health and Human Development. (2000). *Report Of the National Reading Panel. Teaching Children to read: An Evidence-based assessment of the scientific research literature on reading And its implications for reading instruction: Reports of the subgroups* (NIH Publication No. 00-4754). Washington, D.C: U.S. Government Printing Office.

Pearson. (n.d.). *aimswebPlus*. Retrieved February 17, 2020, from https://www.pearsonassessments.com/store/usassessments/en/Store/Professional-Assessments/AcademicLearning/Brief/aimswebPlus/ p/100000519.html

ProLiteracy. (2020). *Adult Literacy Facts*. Retrieved February 10, 2020, from https://proliteracy.org/Adult-Literacy-Facts

28

Tannenbaum, K. R., Torgesen, J. K., & Wagner, R. K. (2006). Relationships between word knowledge and reading comprehension in third-grade children. *Scientific Studies of Reading*, *10*(4), 381-398. https://doi.org/10.1207/s1532799xssr1004_3

Scarborough, H.S. (2001). Connecting early language and literacy to later reading (dis) abilities: Evidence, theory and practice. In S. Neuman & D. Dickinson (Eds.), *Handbook for Research in Early Literacy* (pp. 97-110). New York: NY Guilford Press.

Share, D., Jorm, A., Maclean, R., & Matthews, R. (1984). Sources of individual differences in reading acquisition. *Journal of Educational Psychology*, *76*(6), 1309-1324. https://doi.org/10.1037/0022-0663.76.6.1309

Seidenberg, M. (2017). *Language at the speed of sight: How we read, why so many can't, and what can be done about it.* NY: Basic Books.

The Nation's Report Card (2019). *2019 NAEP Reading Assessment*. Retrieved February 9, 2020, from https://www.nationsreportcard.gov/highlights/reading/2019/

Wagner, R., Torgesen, J., & Rashotte, C. (1994). Development of reading-related Phonological processing abilities: New evidence of bi-directional causality From a latent variable longitudinal study. *Developmental Psychology*, *30*(1), 73-87. https://doi.org/10.1037/0012-1649.30.1.73

Wixson, K. (1986). Vocabulary instruction and children's comprehension of basal stories. *Reading Research Quarterly*, *21*(3), 317-329. https://doi.org/10.2307/747712