

***Efficacy of the Zoo-phonics Multisensory Language Arts
Program for Kindergarten Children
Ohio County School District, Kentucky***

2014 - 2015



An Independent Study Conducted by E3 Research

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Introduction:

This research was designed to study the efficacy of the *Zoo-phonics® Multisensory Language Arts Kindergarten Program*. This program has demonstrated high potential as an integrated, active, multisensory curriculum in previous studies. Ohio County Schools, in rural Kentucky, was chosen for this study because it had not previously used the *Zoo-phonics Program* before its initial training, had lower-than-expected student performance in previous years, and offered a low SES and rural setting for the study, common to many schools in the United States.

The initial studies of a multi-sensory approach to early literacy, the *Zoo-phonics* methodology was determined to be efficacious (Griffith, 2014; Liu, 2014) and founded in current neuroscience research. It uses pictorial mnemonics (Ehri, et al, 1984; Asher, 1993), movement (Asher, 1993; Jensen, 2000; Medina 2008; Rately, 2009), sensory exploration and novelty (Medina, 2008). *Zoo-phonics* quickly gains and keeps children's attention. As a result,

new learning is quickly embedded into long term memory (Jensen, 2000). Children learn more effectively when they purposefully move. Exercise and movement maximize attention, understanding, memory, utilization and transference to all areas of the language arts process (American Academy of Pediatrics, "The Crucial Role of Recess in School," 2012).

Earlier studies on the *Zoo-phonics Multisensory Language Arts Program* indicate that little boys learned language arts skills at the same rate as little girls, providing them confidence and a strong foundation for more advanced learning (Scott, Spielmans, & Julka, 2012). Children with less enrichment and economic stability learned alphabetic skills just as quickly and easily as more affluent children (Kimmons and Staff, 2009). Additionally, English Language Learners and students with academic delays learned at the same or similar rate as traditional students in the area of alphabetic knowledge and other literacy skills. (Wrighton, 2010; Liu, 2014).

Zoo-phonics Multisensory Language Arts Program Description

The *Zoo-phonics Multisensory Language Arts Program* is a developmental, sequential and comprehensive phonics- and literature-based language arts program for early and primary education: toddlers, preschoolers, kindergarten and 1st grade, as well as for various ages of English Language Learners (ELL) and Special Needs students. Beginning with the teaching of the alphabet, phonemic and print awareness, the curricula move children playfully, developmentally, and physically into each of the early reading, spelling and writing domains.

Children *first* learn through the *Lowercase Animal Alphabet* where animals are drawn directly into the shape of each lowercase letter. Each Animal Letter has a related body movement, called a Signal, that acts as the catalyst that cements the letter sounds to the letter shapes (alligator's jaws open and close, /a/; bear reaches for honey, /b/; cat washes her face, /c/, etc.). This transforms abstract symbolism into the concrete realm for student understanding and access.

Each animal letter has an Alliterative Animal Name that helps children master the sounds of the letters quickly: allie alligator, bubba bear, catina cat, etc. The children "see, say, hear and do" as well as touch, sing, dance, pantomime, toss, catch, slither, jump and run.

The *Capital Animal Alphabet* is comprised of the capital letters with the same animals as the lowercase alphabet, which provides an associative affect for easy mastery.

Zoo-phonics teaches the alphabet as a whole entity and in alphabetical order. *Zoo-phonics* focuses on the lowercase letter shapes and their sounds first because 95% of text is written with lowercase letters. Children sound-blend words with sounds, not letter names. Letter names and capital letters are taught next. Children learn the shapes, sounds and Signals of the letters so quickly that there is no need to teach the most frequently used letters first. Within two months, most children have mastered the entire alphabet.

A variety of instructional curricula and materials support each step of the language arts process, including both Animal Alphabets (pictorial mnemonics for lower and uppercase letters), grade-specific decodable readers, music that teaches the alphabet and phonetic concepts, puppets for letter sound reinforcement, mini-books and readers, interactive technology, alphabet and phonics games, and a complete handwriting program. An assessment inventory provides quick tests for the teacher, and tools help to remediate, accelerate, and set goals and objectives for each student. A strong parent component is included in the daily lessons. The curricula

are digitized for Smart Boards. *Zoo-phonics* also offers *Zoo-phonics en español, a Spanish Multisensory Language Arts Program*. Arabic and Danish versions are being developed.

As children learn the alphabet, playful, physical and relevant instruction is directly connected through each letter sound in the areas of literature, math, music, art, sensory-drama, science, social sciences, cooking and nutrition, and physical education. These lessons are available in the *Zoo-phonics Adventuresome Kids Manual on CD* for preschool and kindergarten.

Once the alphabet is mastered, initial, ending and medial sounds are taught. These letters can then be strung

together to form simple vowel-consonant (VC) and consonant-vowel-consonant (CVC) words. Children are taught to segment, blend, and rhyme at this time. They continue to use their bodies to Signal out the sounds in the words, inputting new information into long term memory. Soon, more complex phonetic concepts are sequentially taught (blends, digraphs, schwa, long vowels, r controlled vowels, silent letters, soft sounds etc.) still using the Signals, until mastery and independence is achieved. Children will now have strategies to decode large, unfamiliar words. They learn to read words and simple-to-more-complex sentences as they master phonetic skills. Close reading experiences help children explore text that is read to them as well as when they later read independently.

The Essences of Zoo-phonics

1. The pictorial *Animal Alphabets* (upper and lowercase) helps children remember the shapes and sounds of the letters.
2. Letter sounds are taught before letter names. You cannot sound-blend with letter names.
3. Lowercase letters are taught before capital letters, as lowercase letters are used 95% of the time in text.
4. An animal-related body movement (called a Body Signal or Signal) for each Animal Letter helps “cement” the graphemes and phonemes into memory (connecting sounds to letter shapes) and adds a physical response for inputting and retrieving information.
5. The alphabet is taught sequentially and as a whole entity, “a – z.” The alphabet is not fragmented.
6. Short vowels are taught before long vowels because there are many short vowel words for children to master, including many High Frequency Words.
7. Phonemic patterns (at, bat, fat, sat) are taught first. High frequency words that are easy to sound-blend are also taught (up, on, at, not, did, etc.). More challenging high frequency words (of, it, was, etc.) are taught through their phonetic word families (rimes) later. **Children’s brains need patterns in order to learn.**
8. The *Zoo-phonics* curricula are fully integrated with other academic subjects (math, art, music, science, physical education, social studies, cooking, sensory-drama and self-help skills) daily.

Definitions

1. *Alphabetic Domain*: The Alphabetic Domain is defined as a combination of alphabet knowledge: lower- and uppercase letter shapes, sounds, letter names (in *Zoo-phonics*, *Animal Alphabets*, *Signals* and *Alliterative Animal Names* are included); beginning, ending and medial sounds in words.
2. *Phonics Domain*: For these studies, this domain includes segmenting, blending, adding and subtracting sounds (phonemic manipulation); schwa, blend and digraph knowledge.
3. *Reading Fluency Domain*: This domain includes sound blending and reading vowel-consonant words (VC) and consonant -vowel-consonant words (CVC); sound blending and reading High Frequency Words.
4. *Comprehension Domain*: Understanding of the written word.
5. *Kindergarten*: Children normally begin kindergarten (or K) at 5 years of age. Rules vary by state.
6. *Phonological Awareness Literacy Screening (PALS-K)* instrument. This instrument was developed by the University of Virginia and measures several indicators of early literacy. *PALS-K* is well-respected, and is used with all students in the States of Virginia and Wisconsin, and around the United States. It was the primary assessment instrument used in this study.

7. *Zoo-phonics Basic Reading Assessment 3 (Z-BRA 3)*: This assessment covers all aspects of phonemic awareness, alphabetics, the 4 reading domains, and written language. The *Z-BRA 3* was used as a secondary assessment and was used when *PALS-K* did not supply the need for specific testing.
8. *STAR Early Literacy Computer-Based Diagnostic Assessment* assesses these eight key domains of early literacy and numeracy. The domains and skills are grouped into three major areas that relate to state standards. This test is used nation-wide and is used to give an indication of how districts and states compare to each other.
9. *Baseline*: Also called Pre-Test. This is the test given at the beginning of the year to determine student alphabet, phonics, and word knowledge.
10. *Assessment Periods*: The school year is divided into 3-month blocks of time. Assessments occur at the baseline or Pre-Test, the 1st Trimester (also called the Mid-Term), and 3rd Trimester (or Post-Test).
11. *"Business as Usual" Model*: This refers to the manner in which the *Zoo-phonics Language Arts Program* was taught. It was "business as usual." All aspects of language arts were taught as a part of the normal teaching routine.
12. *Social-Economic Status (SES)*: This is the economic and ethnic make-up of participants in the study group.
13. *Merged Animal Alphabets*: *Zoo-phonics* uses animals drawn in the exact shape of the lowercase letters. They sit on top of the lowercase letters for a visual and mnemonic impact. The capital letters contain the same animals for an associative affect.
14. *Alliterative Animal Names*: *Zoo-phonics* uses alliterative animal names (bubba bear) to teach the sounds of the letters. This has a strong effect on memory when connected with the Animal Alphabets and the Body Movements (Signals).
15. *Signals*: The animal-related body movement that connects the sounds and shapes of the *Zoo-phonics Animal Alphabets*.
16. *Benchmarks*. Benchmarks provide a learning target for a span of grades. The state benchmarks are aligned with state content standards in most states. Assessments help determine if benchmarks have been reached.

The Study

Purpose:

The purpose of this study was to determine the efficacy of the *Zoo-phonics Multisensory Language Arts Kindergarten Program* in authentic kindergarten settings in six elementary schools in the Ohio School District in rural Kentucky.

Research Questions:

RQ1: Do kindergarten students receiving the *Zoo-phonics Multisensory Language Arts Program* demonstrate greater growth in reading skills outcomes (alphabetics, reading fluency, comprehension)?

RQ2: Are there differences in alphabetic skill levels between sub-groups (ethnic groups, low SES, gender) after receiving *Zoo-phonics Multisensory Language Arts Instruction* treatment as measured by the *PALS-K*, *STAR* and *Z-BRA3*?

RQ3: Do students who have received the *Zoo-phonics Multisensory Language Arts Program* reach benchmarks established by *PALS-K* and *STAR*?

Methodology:

A study of the efficacy of the *Zoo-phonics Multisensory Language Arts Program* for kindergarten children was conducted during the 2014-2015 school year by E3 Research, LLC. The study was conducted in Ohio County, Kentucky, using 320 kindergarten students in six schools.

Instruments:

Three instruments were used to collect data during the study. The primary assessment instrument used in the study was the *Phonological Awareness Literacy Screening (PALS-K)* instrument. This instrument was developed by the University of Virginia and measures several indicators of early literacy. *PALS-K* is used with all students in the States of Virginia and Wisconsin and is well-respected throughout United States. Supplementary data were collected using the *Zoo-phonics Basic Reading Assessment, Version 3 (Z-BRA3)*. Additionally, students were assessed three times during the school year using *STAR Early Literacy*. This array of instruments assured that key learning not assessed by *PALS-K* would be assessed by one of the other tests. Additionally, the use of multiple assessments gave comparative data and perspective to the results measured by *PALS-K*.

Data were collected by teachers and instructional assistants trained in each assessment:

- 1) at the beginning of school year using *PALS-K*, the *Z-BRA3*, and *STAR*,
- 2) at the end of the first Trimester (November) using the *Z-BRA3*,
- 3) midway through the year (January) using *STAR*,
- 4) at the end of the school year (June) using *PALS-K*, *Z-BRA3* and *STAR*.

Participants:

Fifteen teachers participated in the study. All kindergarten teachers were credentialed by the state of Kentucky and received intensive training and ongoing support in the techniques and curriculum developed for the *Zoo-phonics Multisensory Language Arts Program*. Instructional assistants received training in *Zoo-phonics* at the same time and intensity of their teachers. They were also trained to administer the *Z-BRA3*.

Teachers and school administrators agreed to implement and use the *Zoo-phonics Program* with fidelity, using the curriculum, materials and instructional techniques as designed.

At the beginning of the study 320 kindergarten students participated in the study with a gender mix of nearly equal numbers of boys (50.3%) and girls (49.7%). However, 287 students completed all tests throughout the course of the year so only 287 student test scores are used in this study. Students eligible for free or reduced-cost lunches were 68%, indicating a community composition that is largely economically disadvantaged.

The racial composition of the study group was relatively homogeneous, with 80% white, 11% Hispanic, 1% black and the remainder consisting of American Indian and unspecified. Many of the Hispanic students were from families who have resided in the area long enough to self-identify English as their family's primary language. Only 5% of the students in the study were reported to have English as their second language.

The age-range of students in the study was between 4 years and 9 months and 7 years and 9 months. Most students were in the 5-year old range. Twenty three students began kindergarten less than 5 years old while 42 students were older than 5 years.

Two disability categories are identified. Students reported with speech and language disabilities were 2.8%, and students reported with developmental delays were 5.3%. Both groups were included in the assessment process.

Of the 320 students in the kindergarten cohort, 214 (66%) attended Head Start or preschool prior to entering kindergarten. The remaining 34% did not.

Data Analysis:

The data were analyzed using:

- Descriptive statistics (means, frequencies, standard deviations and gains between assessments)
- T-Tests to measure the significance between Pre- and Post-mean scores, Analysis of Variance (ANOVA) t-test differences in means (for groups or variables) for statistical significance
- Group Statistics
- Independent Samples Tests (Levine's Test for Equality of Variance and Test of Equality of Means to test for variability between scores
- Cohen's *d* to test for effect size; used to indicate the standardized difference between two means

The significance level for all tests was set at $p \leq 0.05$.

Procedures:

Prior to the beginning of the school year, all kindergarten teachers and their instructional assistants received intensive training in the use of *Zoo-phonics* instructional techniques, curriculum and materials. Each class room was supplied with a complete set of age-instructional *Zoo-phonics* kindergarten materials. The principals of the participating schools and the Assistant Superintendent in charge of instruction were also trained in the *Zoo-phonics Program*.

During the first two weeks of school, all students were assessed using *PALS-K*. Data were collected manually and then entered into the *PALS-K Online System* at a later date. *PALS-K* does not test for uppercase letters or uppercase sounds in the Pre-Test. As a pre-post assessment, it does not measure how quickly students become proficient in the alphabet, an important component of understanding early literacy development. A second assessment was conducted using the *Z-BRA3* to address these gaps. This assessment included upper- and lowercase letter names, sounds, *Zoo-phonics* Alliterative Animal Names and Signals specific to each Animal Letter. The *Z-BRA3* was used to establish an alphabetic knowledge baseline that would be re-assessed in November.

The *Zoo-phonics Program* is designed to teach alphabets quickly, typically within the 1st Trimester (November) of preschool and kindergarten. The alphabetic component of the *Z-BRA3* was administered during the first two weeks of school and at the end of the 1st Trimester to test how quickly students achieved mastery of letter names, shapes and sounds. The *Z-BRA3* was used at the end of the year to test advanced literacy concepts including reading and comprehension that are not available in the *PALS-K* instrument.

The *STAR Early Literacy* assessment was administered three times during the school year to benchmark literacy performance.

PALS-K, *Z-BRA3* and *STAR* were all administered at the end of the school year. This data was used to compare against *PALS-K* and *STAR* benchmarks and provide pre-post data to demonstrate the growth of each student, the school and the district as a whole.

Findings:

The findings of this study were derived primarily through *PALS-K*. Supplementary findings resulted from *Z-BRA3* and *STAR* testing included lowercase and uppercase letters and sounds, analysis and synthesis of words, vowel-consonant (VC) and consonant-vowel-consonant (VC/CVC) words, reading and comprehension. *PALS-K* was used to benchmark groups of students as a measure of growth throughout the year and for identification of students needing early or targeted interventions. *STAR* benchmarks provided similar corroborative information.

***PALS-K* Analysis:**

PALS-K measures children's knowledge of several important literacy fundamentals: phonological awareness, alphabet recognition, concept of word, knowledge of letter sounds and spelling. *PALS-K* provides a direct means of matching literacy instruction to specific literacy needs and provides a means of identifying those children who may be behind in their acquisition of these fundamental literacy skills.

PALS-K measures kindergarten students' development of early literacy skills, especially awareness of speech sounds and knowledge of print. The phonological awareness component of the *PALS-K* instrument measures students' ability to identify rhyme units and isolate beginning sounds. The literacy component of the *PALS-K* instrument is a measure of knowledge of important literacy fundamentals including: contextual knowledge and spelling.

Twelve measures are used in *PALS-K* (Table 1). T-tests were used to determine the differences in fall mean scores and spring mean scores for each test. Each test resulted in a significant gain. As a result of each *p* value of .000, we can conclude that the changes did not occur by chance.

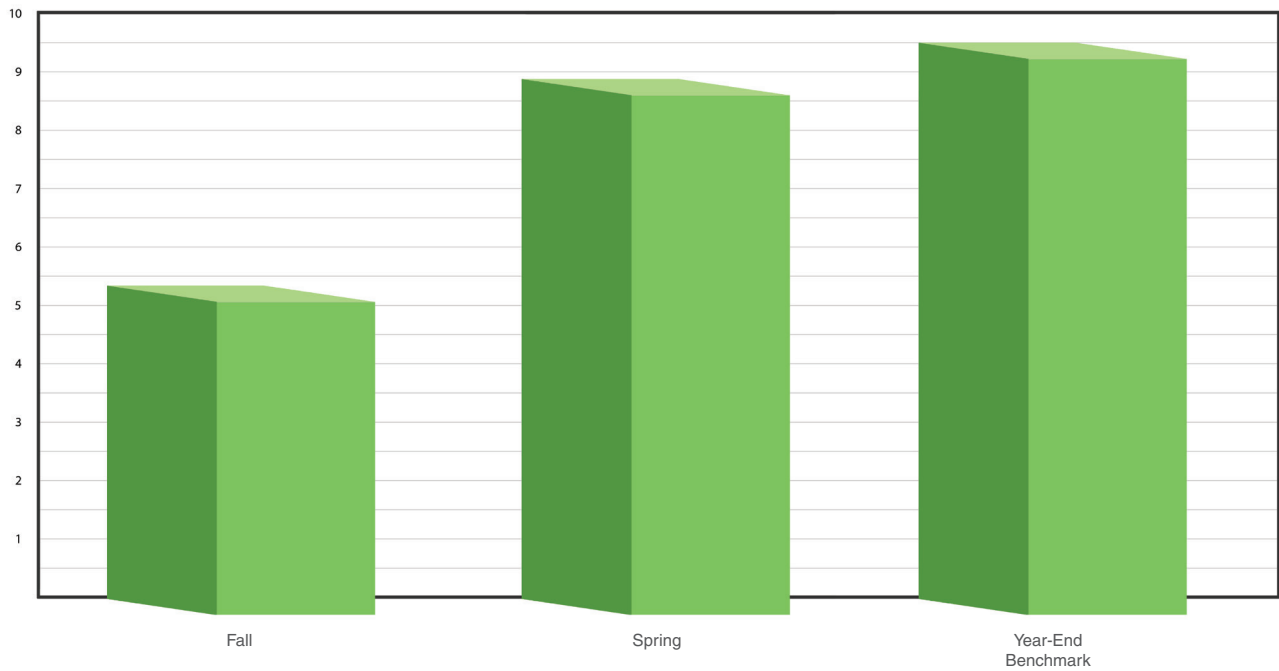
Table 1.0 - *PALS-K* Assessment Categories

Test	Number of students	Pre-Test Mean	Post-Test Mean	Significance $p \leq 0.05$.
Group Beginning Sounds	287	5.38	8.90	.000
Lowercase Letters	287	11.61	25.6	.000
Letter Sounds	287	10.22	23.68	.000
Spelling	287	3.21	18.13	.000
Pointing	287	1.38	3.76	.000
Word ID	287	2.68	7.18	.000
COW – Word List	287	0.84	5.14	.000
COW-Total	287	4.9	16.08	.000
WRI – Pre-Primer	287	0.73	14.39	.000
WRI – Primer	68	0.40	6.16	.000
WRI- 1st Grade	60	0.03	1.45	.000
Kindergarten Summed Scores	287	35.82	89.64	.000

“Brain-derived Neurotrophic Factor (BDNF) is...Miracle-Gro® for the Brain...a crucial link between thought, emotions, and movement... Eric Kandel [found] that repeated activation, or **practice**, causes the synapses themselves to swell and make stronger connections...exercise sparks the master molecule of the learning process...a direct biological connection between movement and cognitive function.”

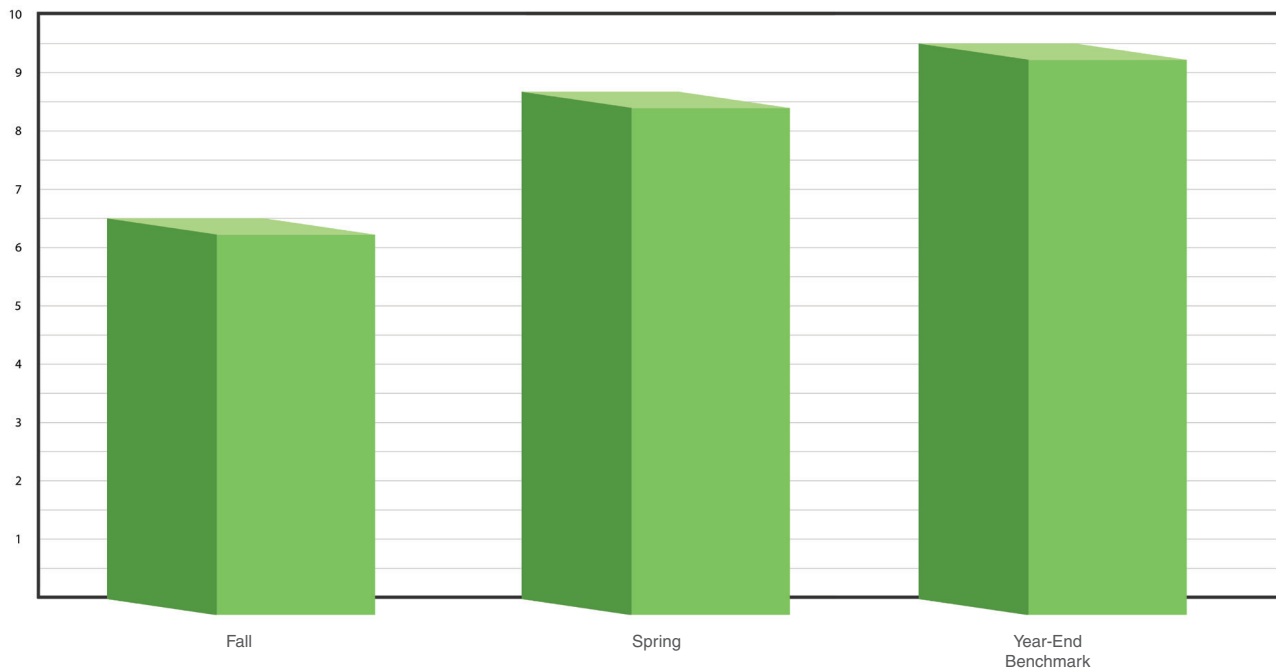
- *Spark*, (Ratey, 2008, pps. 40- 43).

Graph 1 - Beginning Sounds in Words



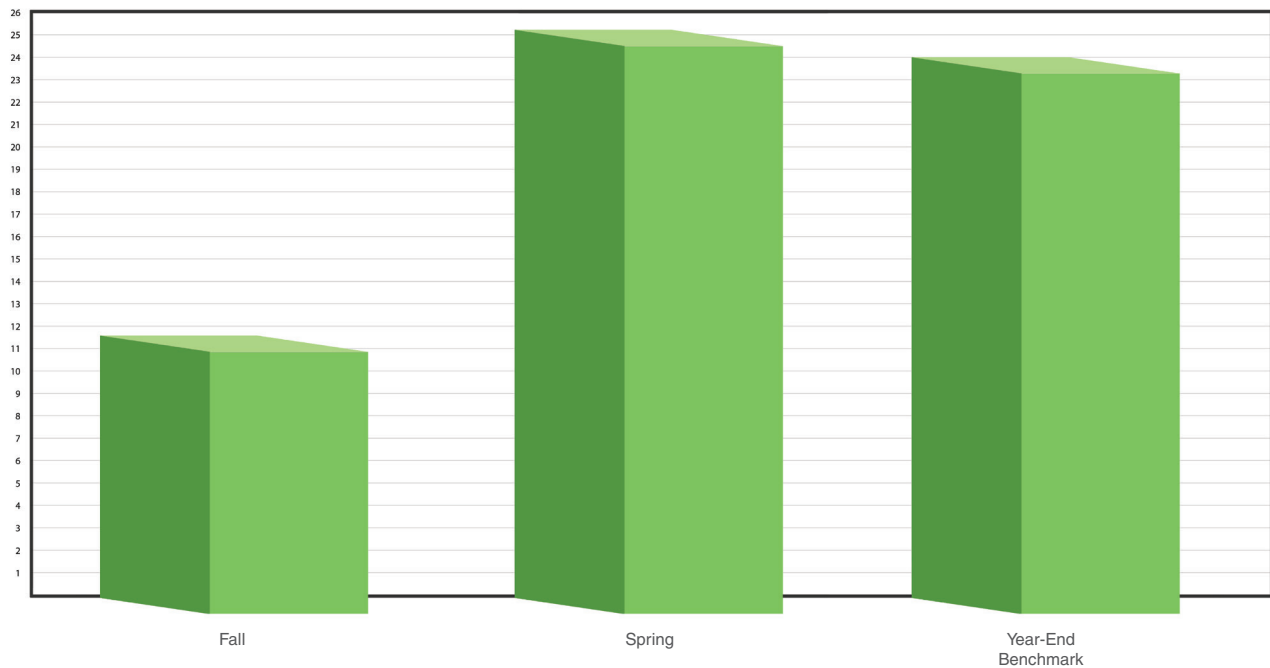
Out of a set of three pictures, students are asked to identify the one that has the same beginning sound as the target picture on ten items. Data show that between the Pre-Test and the Post-Test there was a significant gain. Students began the school year with a moderate understanding of beginning sounds. By the end of the year, a mean score of 8.9, compared to the Benchmark of 9.0, indicates that students clearly understood the concept of beginning sounds and how they are used in forming words.

Graph 2 - Group Rhyme



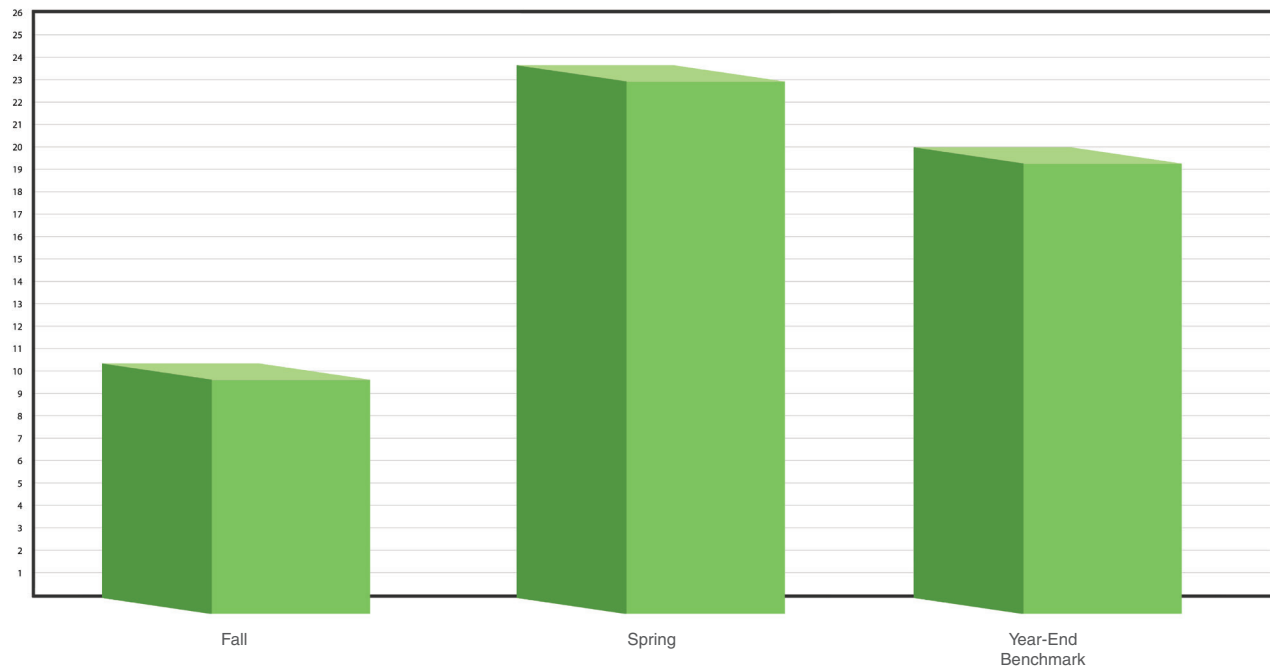
Rhyming is a key concept in the English language acquisition and while students were familiar with rhyming at the beginning of the year, mastery had not been achieved at that point. Data show that between the Pre-Test and the Post-Test there was a significant gain. With a mean score of 8.68, the concept of rhyming across 287 students is strong compared to a year-end Benchmark of 9.0.

Graph 3 - Lowercase Letter Recognition



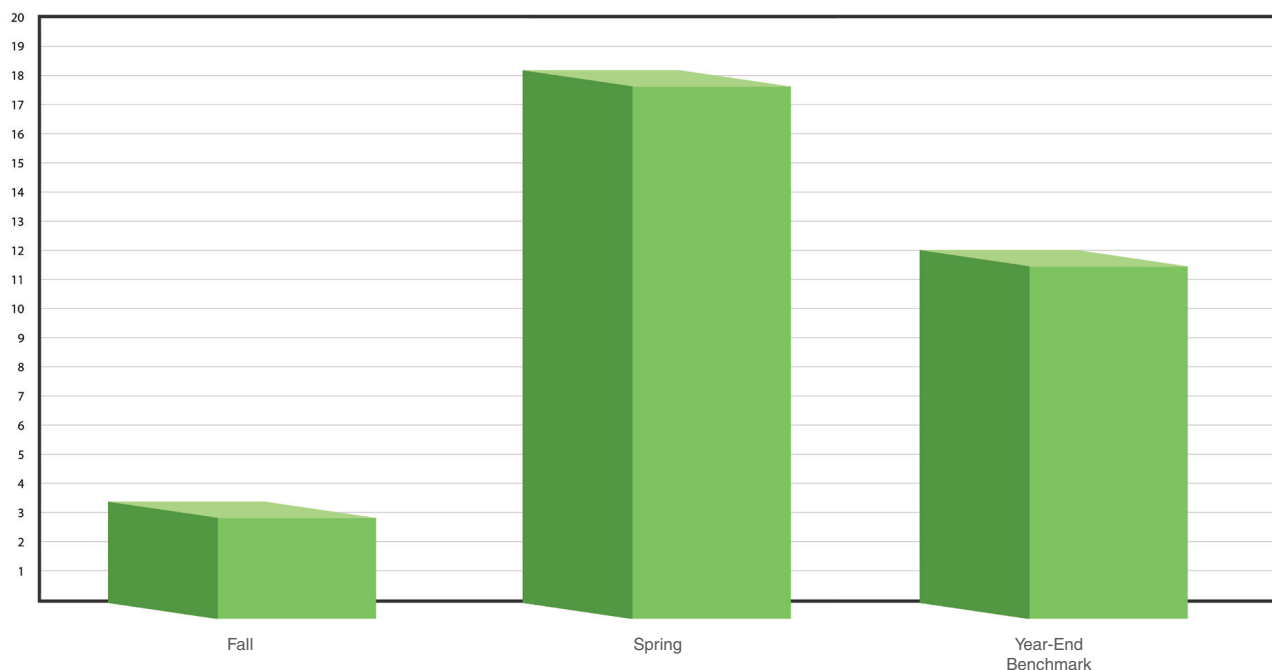
Lowercase alphabet knowledge was measured using both *PALS-K* and the *Z-BRA3*. Students entered kindergarten with a moderate knowledge of lowercase letter shapes. In the Pre-Test, when students recognized the lowercase letters, they called them out by the letter name. By the first trimester, they called them by their Alliterative Animal Names and gave the sounds and Signals. By the end of the year, the lowercase alphabet *PALS-K* Benchmark had been achieved and surpassed by most students. With a strong emphasis on alphabetics, this would be expected from students receiving *Zoo-phonics* instruction. The Pre-Test mean score was high because some students received *Zoo-phonics* prior to attending kindergarten while in the Ohio County School District Head Start/Preschool Program.

Graph 4 - Lowercase Letter Sound Recognition



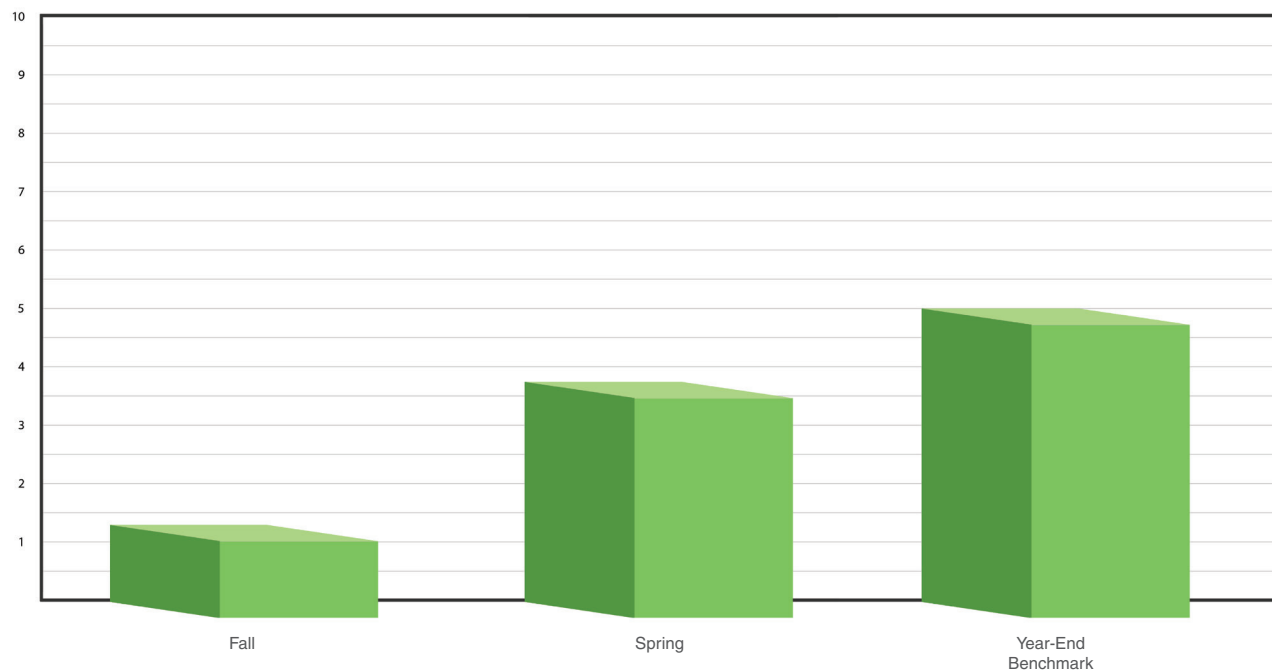
As with letter shapes, *Zoo-phonics* emphasizes lowercase letter sounds from the beginning of instruction. Data show that between the Pre-Test and the Post-Test there was a significant gain. With a mean score of 10.22 in the Pre-Test and 23.68 in the Post-Test, skills in letter sounds across 287 students is strong compared to a year-end Benchmark of 20.0. The Pre-Test mean score was high because some students received *Zoo-phonics* prior to attending kindergarten while in the Ohio County School District Head Start/Preschool Program.

Graph 5 - Spelling



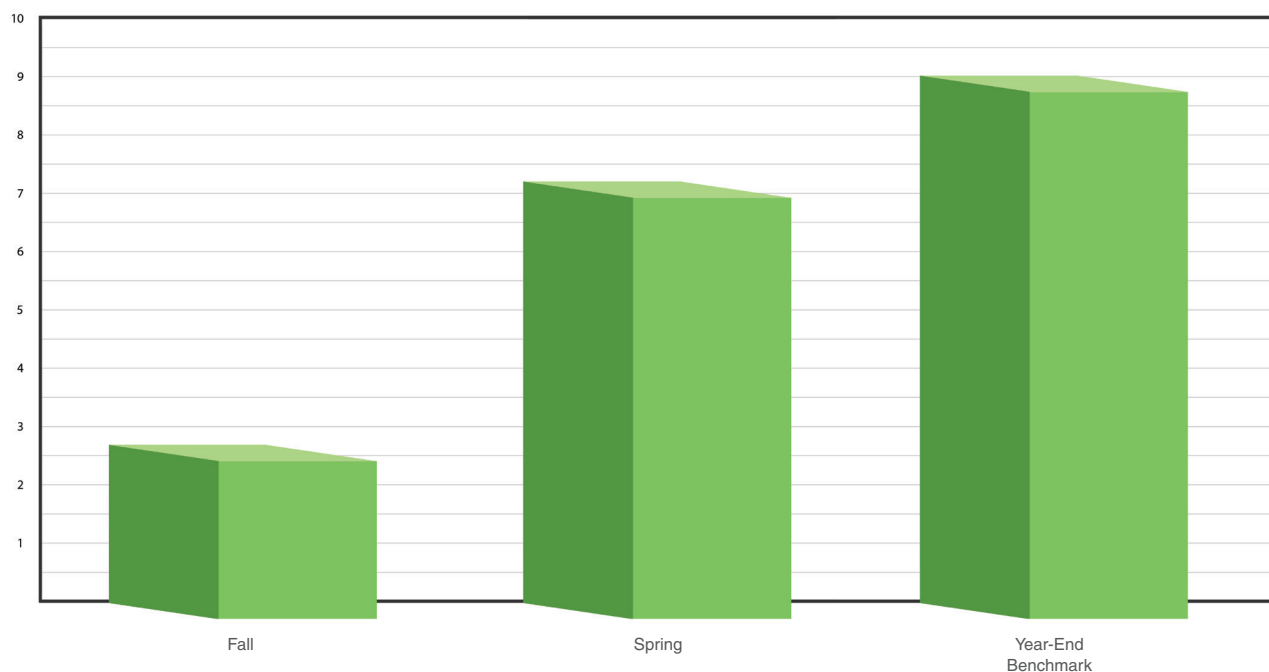
Students spell five consonant-vowel-consonant (CVC) words, receiving credit for phonetically acceptable substitutions. A mean score of 3.21 in the Pre-Test and 18.13 in the Post-Test demonstrates strong growth. With above-benchmark scores in several categories, high levels of proficiency in spelling were realized. Students scored, on average, 18 in spelling against a benchmark of 12. This indicates that students not only knew basic concepts of word formation, they could also apply that understanding to other word concepts including forming words from sounds.

Graph 6 - Pointing



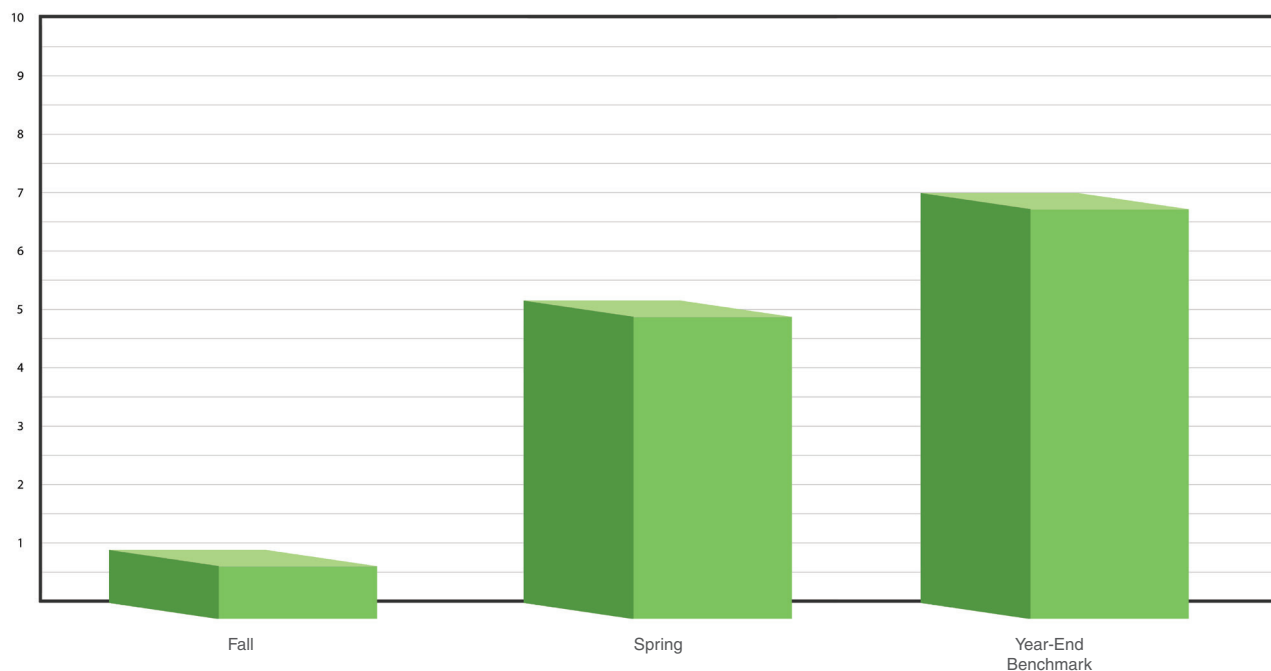
The student was shown five pictures. The teacher called out a word that matched one of the pictures and the student was to point to the correct one. This is an identification task that connects words with objects. A mean score of 1.38 in the Pre-Test and 3.76 in the Post-Test demonstrates significant growth just short of Benchmark.

Graph 7 - Word Identification



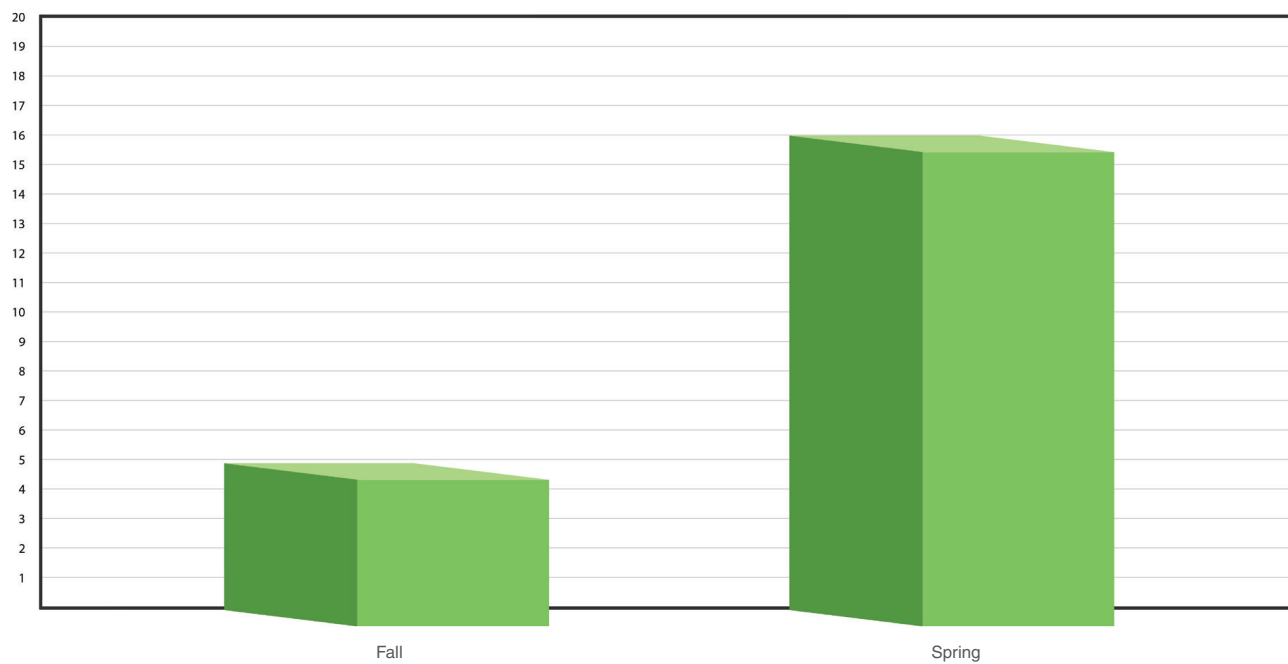
Prior to testing, children were taught a nursery rhyme and were expected to memorize it. The student is then shown the pictures and text from this specific nursery rhyme. The children recite the rhyme while reading the text. The child is then asked to find two words in the line. A mean score of 2.68 in the Pre-Test and 7.18 in the Post-Test demonstrates strong growth, just short of Benchmark. This indicates that students were able to memorize and then recognize words in text.

Graph 8 - Concept of Words - Word List



The Concept-of-Word task measures children's ability to (a) accurately touch words in a memorized rhyme, (b) use context to identify individual words within a given line of text, and (c) identify words presented outside of the text. A mean score of 0.84 in the Pre-Test and 5.15 in the Post-Test demonstrates strong growth, just short of the benchmark of 7. This indicates that students were able to memorize and identify words both in-and-out of context.

Graph 9 - Concept of Words, Total Score



The Concept-of-Word (COW) task measures children's ability to (a) accurately touch words in a memorized rhyme, (b) use context to identify individual words within a given line of text, and (c) identify words presented outside of the text, thus providing an aggregated score.

Students' year-end performance demonstrated remarkable growth (no benchmark was given). The prior three tests were predicated on memorization of a nursery rhyme to be successful, as well as to locate words by sight and sound. Children with a solid Concept of Word will recognize words they didn't know prior to reading a memorized or familiar text, even when these words are presented out of context if aided with a strong foundation of alphabetic knowledge and sound-blending skills.

PALS-K describes Concept of Word (COW) as the emergent reader's ability to match spoken words to written words as he or she reads. Research has shown that a stable Concept of Word in text can facilitate a child's awareness of the individual sounds within words. Until children can point to individual words accurately within a line of text, they will be unable to learn new words while reading or to attend effectively to letter-sound cues at the beginning of words in running text. The ability to fully segment all the phonemes within words appears to follow Concept of Word attainment.

"Physical activity and aerobic exercise helps keep brain healthy. Regardless of gender... [those] who have greater aerobic fitness also have greater volume of their entorhinal cortex, an area of the brain responsible for memory."

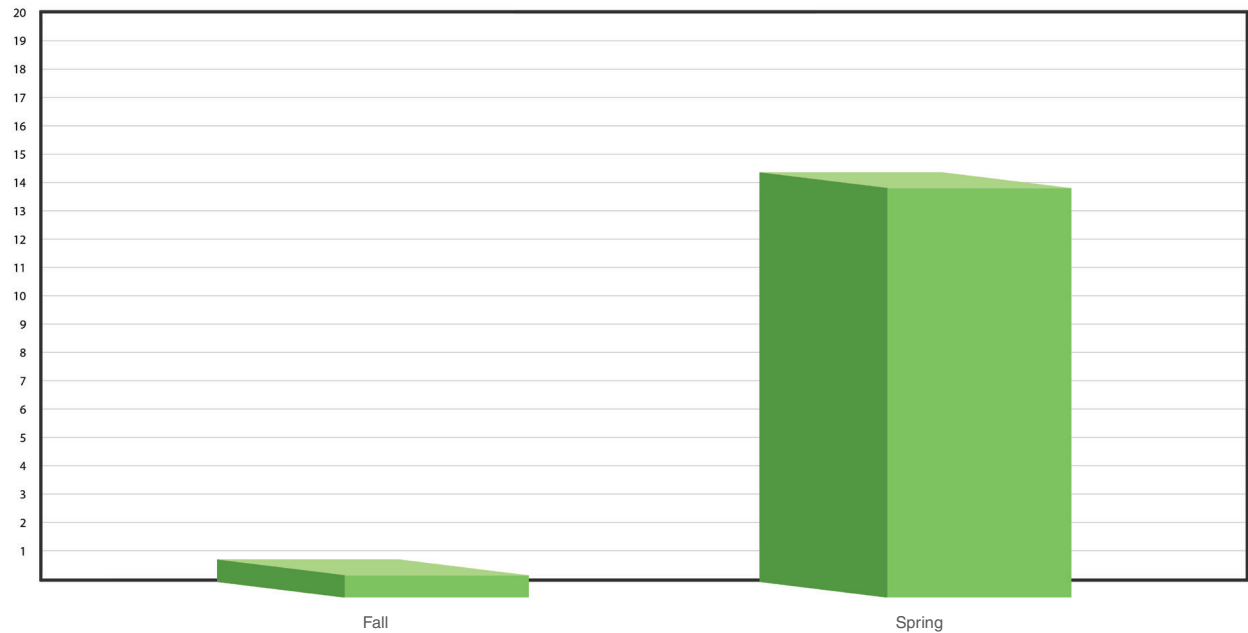
- 2015 Boston University Medical Center; reported by Science Daily

"...it appears now that this motor center also coordinates thoughts, attention, emotions, and even social skills. When we exercise, particularly if the exercise requires complex motor movement, we're also exercising the areas of the brain involved in the full suite of cognitive functions."

- Spark, (Ratey, 2008, p. 41).

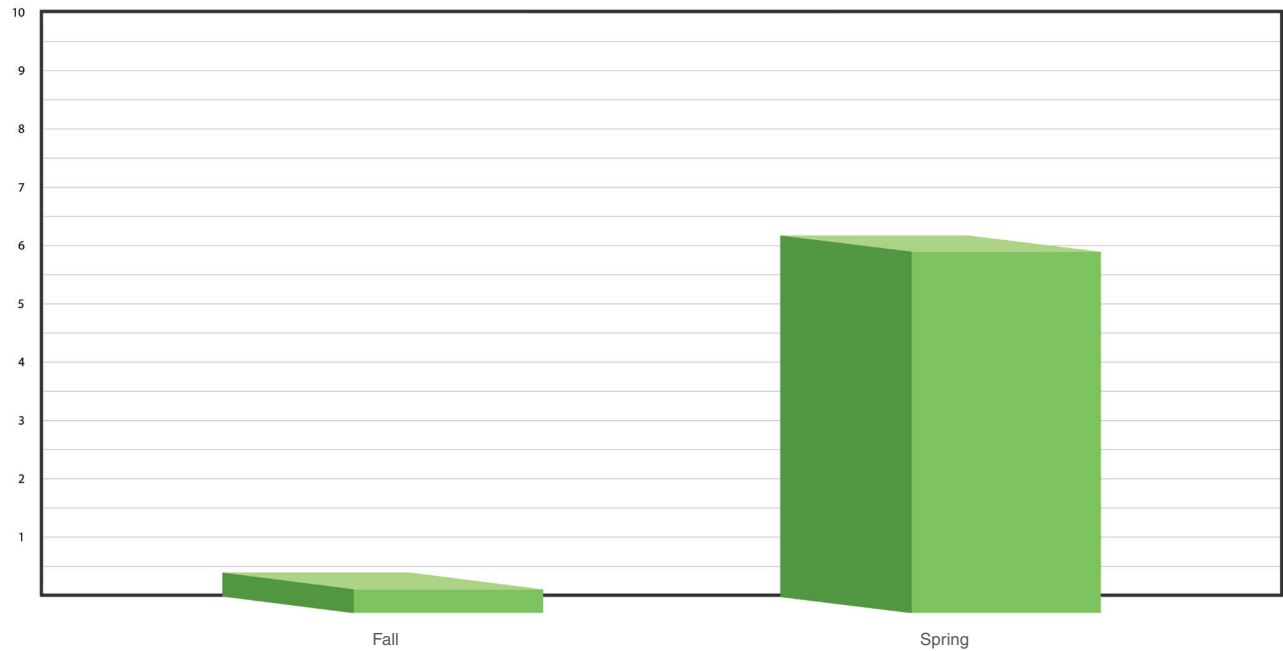
Understanding or creating meaning from print depends on accurate, automatic word recognition and the ability to sound-blend. *PALS-K* provides three optional word lists to measure kindergartners' progress throughout the year: Pre-Primer (Pre-1), Primer (1-1), and 1st Grade (1-2). These were used in Graphs 10 - 12.

Graph 10 - Word Recognition in Isolation - Pre-Primer



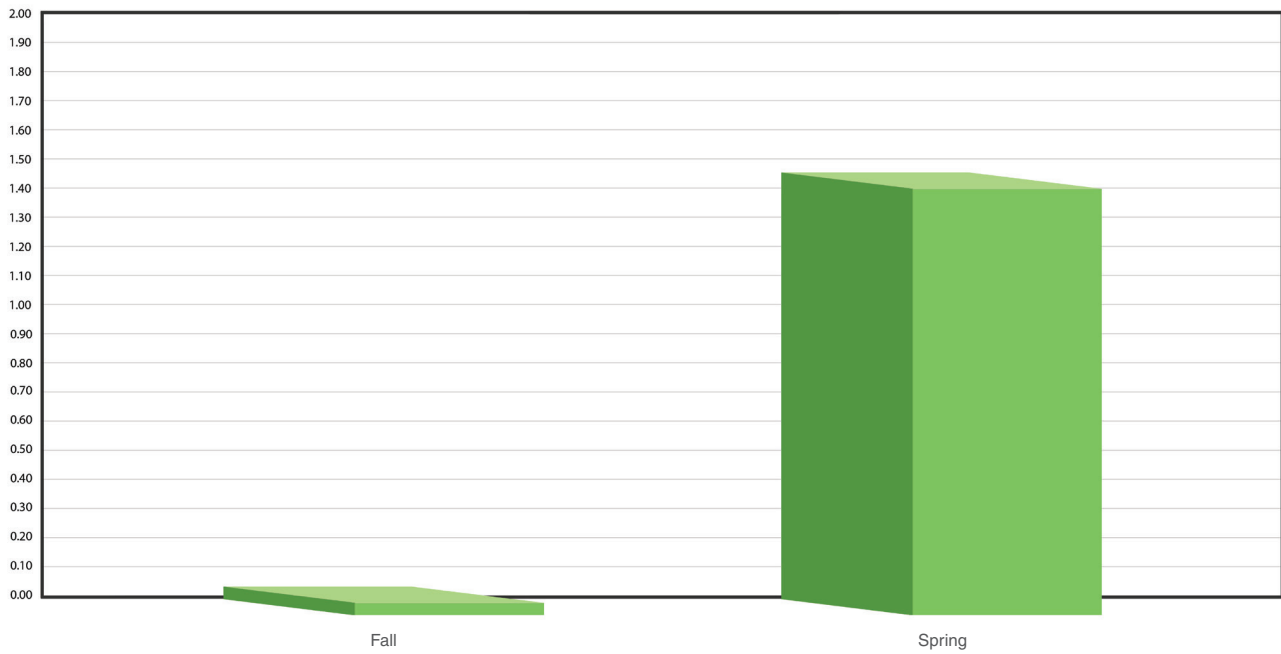
The optional Word Recognition in Isolation assessments were administered to 215 students. While this is not benchmarked, it is an indicator of early reading proficiency. With a mean score of 0.73 in the Pre-Test compared with a mean score of 14.39 in the Post-Test, students demonstrated remarkable growth and achievement.

Graph 11 - Word Recognition in Isolation - Primer



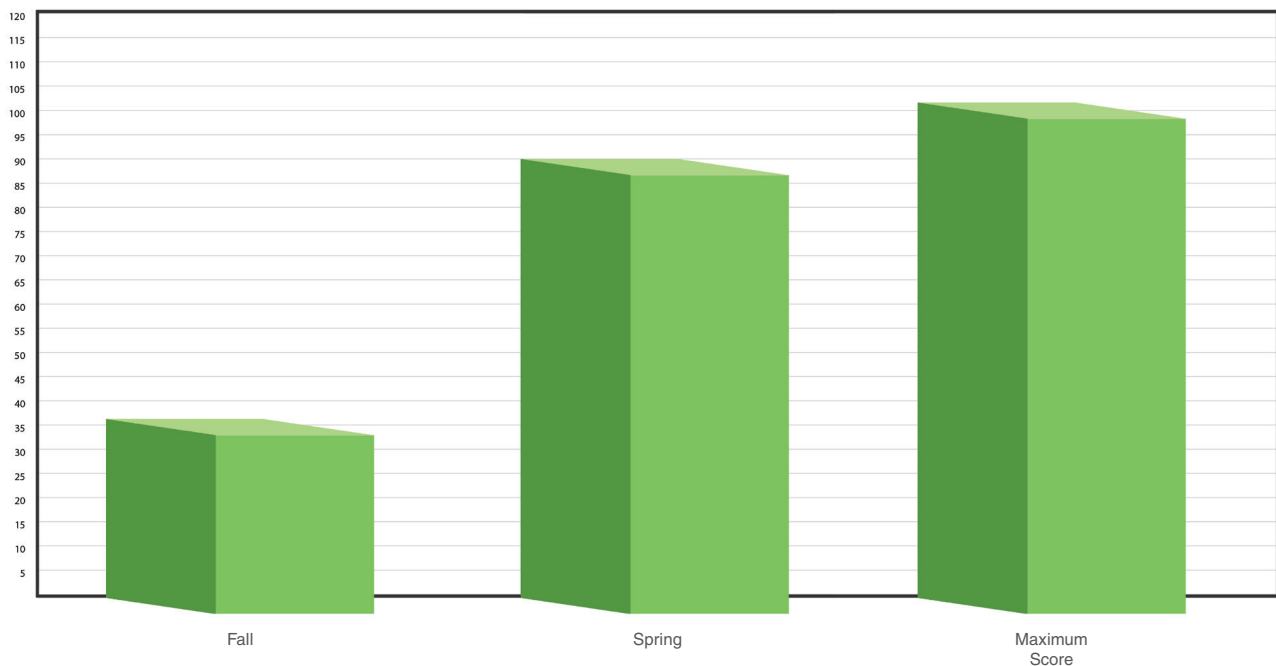
The Primer is considered on the kindergarten level. Significant growth in word recognition was attained by 67 students at the Primer level. A mean score of 0.40 in the Pre-Test compared 6.1 in the Post-Test indicated that students at this level made significant progress in more complex word recognition.

Graph 12 - Word Recognition in Isolation - 1st Grade Level



Out of 287 students, 60 students were able to recognize 1st grade words in isolation. Data demonstrate that 21% of the kindergarten students were able to recognize advanced words at the 1st grade level. The growth of this group of students showed a significant increase between the fall and spring assessments.

Graph 13 - Kindergarten Summed-Score



The Kindergarten Summed Score is a composite of several sub-scale scores seen above and provides a general level of achievement that is not benchmarked in kindergarten. However, a comparison between the Year-End score and the Maximum possible score gives a relative measure of how well children are performing at the end of kindergarten. In this case, the Year-End mean score of 89.64 out of 102 possible, indicates an overall achievement level nearing 90%. This strong score shows significant and marked growth of about 54 points between fall and spring assessments. This same growth is evident in *Z-BRA3* and *STAR* assessment scores as presented below.

Zoo-phonics Beginning Reading Assessment (Z-BRA3) Analysis

The Z-BRA3 was used to supplement the PALS-K assessment, primarily in the Alphabetics Domain, but also in Fluency and Comprehension. This additional assessment was undertaken to extend the assessments into areas that are specifically taught in the *Zoo-phonics Program* but not addressed by PALS-K. T-tests were used to determine the differences in fall mean scores and spring mean scores for each test. Each test resulted in a significant gain. As a result of each *p* value of .000, it can be concluded that the changes did not occur by chance.

The initially high level of alphabetic knowledge, and especially Zoo-phonics-specific knowledge, indicates that a percentage of the students in the study were exposed to Zoo-phonics prior to entering kindergarten.

Testing of alphabetic knowledge at the beginning of the school year and then again at the end of the first trimester is essential as students rapidly gain skills in the alphabetic domain through *Zoo-phonics* instruction.

Lowercase Name

The Z-BRA3 was used to assess lowercase alphabet knowledge as a Pre-Test and at the end of the 1st Trimester (November). Significant gains in letter name knowledge were evident with a mean score of nearly 24 of the 26 letter names known during this period.

Lowercase Letter Sound

Lowercase letter sounds are a key component to early literacy and also of the *Zoo-phonics* instruction design. By the end of the 1st Trimester, students posted a mean score of nearly 25 of the 26 lowercase letter sounds.

Alliterative Animal Names

Alliterative Animal Names, letter sounds and Signals support each other in the *Zoo-phonics Program*. Students showed a significant knowledge gain in Alliterative Animal Names between Pre-Test and the 1st Trimester scores. As with letter sounds, 25 of the 26 associated letters were mastered during the 1st Trimester of kindergarten.

Signals

Signals, Alliterative Animal Names and letter sounds are combined during the 1st Trimester to support student mastery, showing that students learned 25 of the 26 lowercase letter sounds by the end of the 1st Trimester. The mean score is based on 271 students, indicating that scores at the end of Trimester 1 were from the same students who were tested at the beginning of the year.

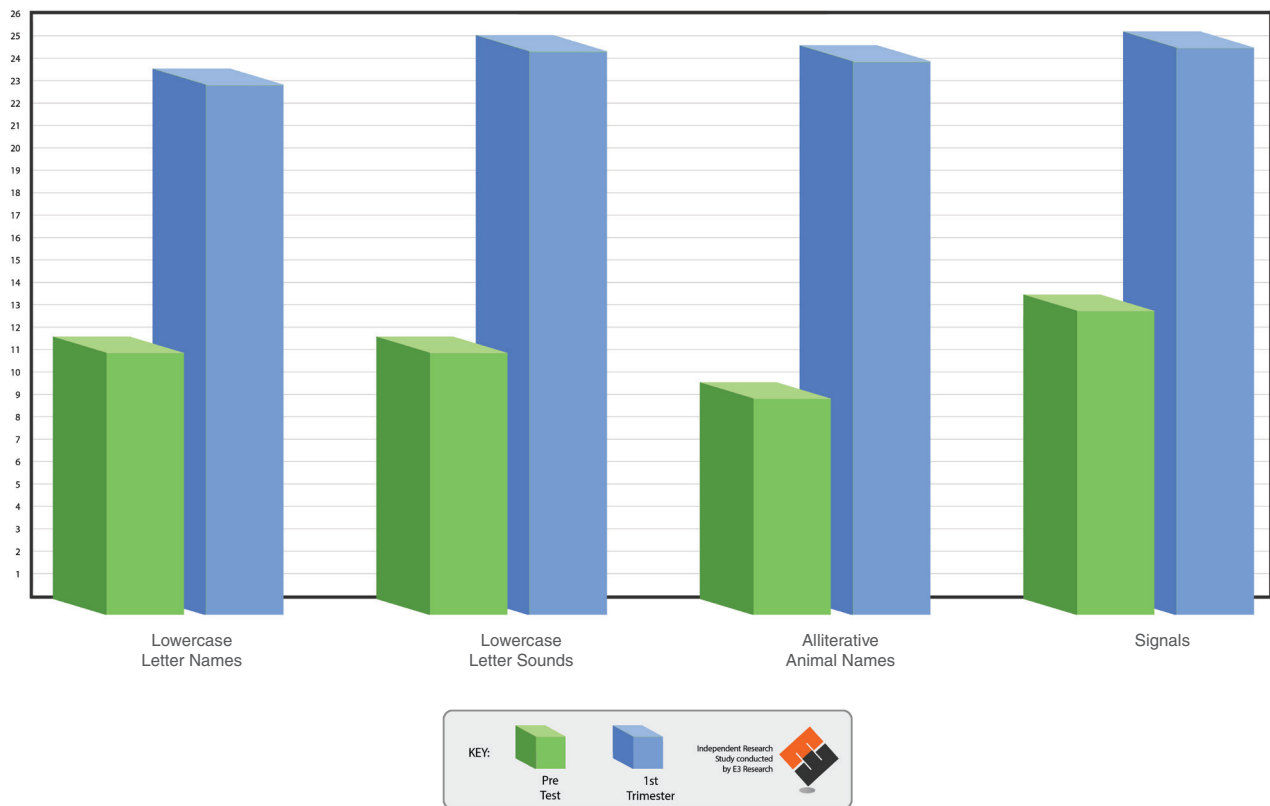
“Physical movement from earliest infancy and throughout our lives plays an important role in the creation of nerve cell networks which are actually the essence of learning.”

- *Smart Moves, Why Learning is Not All in Your Head*, (Hannaford, 1995, p. 12)

“To reap the brain benefits of physical activity, just get moving. Everyone knows that exercise makes you feel more mentally alert at any age. But do you need to follow a specific training program to improve your cognitive function? Science has shown that the important thing is to just get moving. It’s that simple. In fact, this was the finding of a study conducted at the Institut universitaire de gériatrie de Montréal (IUGM), an institution affiliated with Université de Montréal, by Dr. Nicolas Berryman, PhD, Exercise Physiologist, under the supervision of Dr. Louis Bherer, PhD, and Dr. Laurent Bosquet, PhD, that was published in the journal AGE.”

- *American Aging Association*, October, 2014

Graph 14 - Alphabetic Scores



Graph 14 illustrates the growth in alphabetic knowledge between the Pre-Test and the end of the 1st Trimester. During this three-month period students showed significant growth as knowledge of letter names and sounds have more than doubled. Specific to the *Zoo-phonics Program*, Alliterative Animal Names and Signals have also more than doubled. Students gained and used cognitive strategies, such as the *Zoo-phonics Animal Alphabet*, Alliterative Animal Names, and Signals that supported long-term memory. As a result, by the end of the 1st Trimester, students had nearly reached mastery of the lowercase alphabet. High scores in all areas of the *Z-BRA3* Pre-Test show that *Zoo-phonics* lowercase alphabet was taught to some students in the Ohio County School District Head Start/Preschool Program.

Table 2 - Gain in Alphabetic Principles

Gains from Pre-Test to 1st Trimester	
Lowercase Letter Names	12
Lowercase Sounds	14
Lowercase Alliterative Animal Names	15
Lowercase Signals	12

Uppercase Letter Names

Uppercase letter names showed a significant gain between the Pre-Test and the end of the 1st Trimester with the mean score ending at 23 of the 26 letters. Uppercase letter names and shapes are the last alphabet component to be taught but still resulted in near-mastery within the first three months of kindergarten. Lowercase gains were between 12 and 15 while uppercase gains ranged between 11 and 20. Most children have some prior knowledge of capital letters from home and preschool.

Uppercase Letter Sounds

Letter sounds, Alliterative Animal Names and Signals are all taught together to support memory. As a result, mean scores at the end of the 1st Trimester would be assumed to be about the same for each component. The mean scores indicate that nearly all letter sounds (25/26) were mastered. This indicates how strongly these three *Zoo-phonics* components interact to support the development of early alphabetic learning.

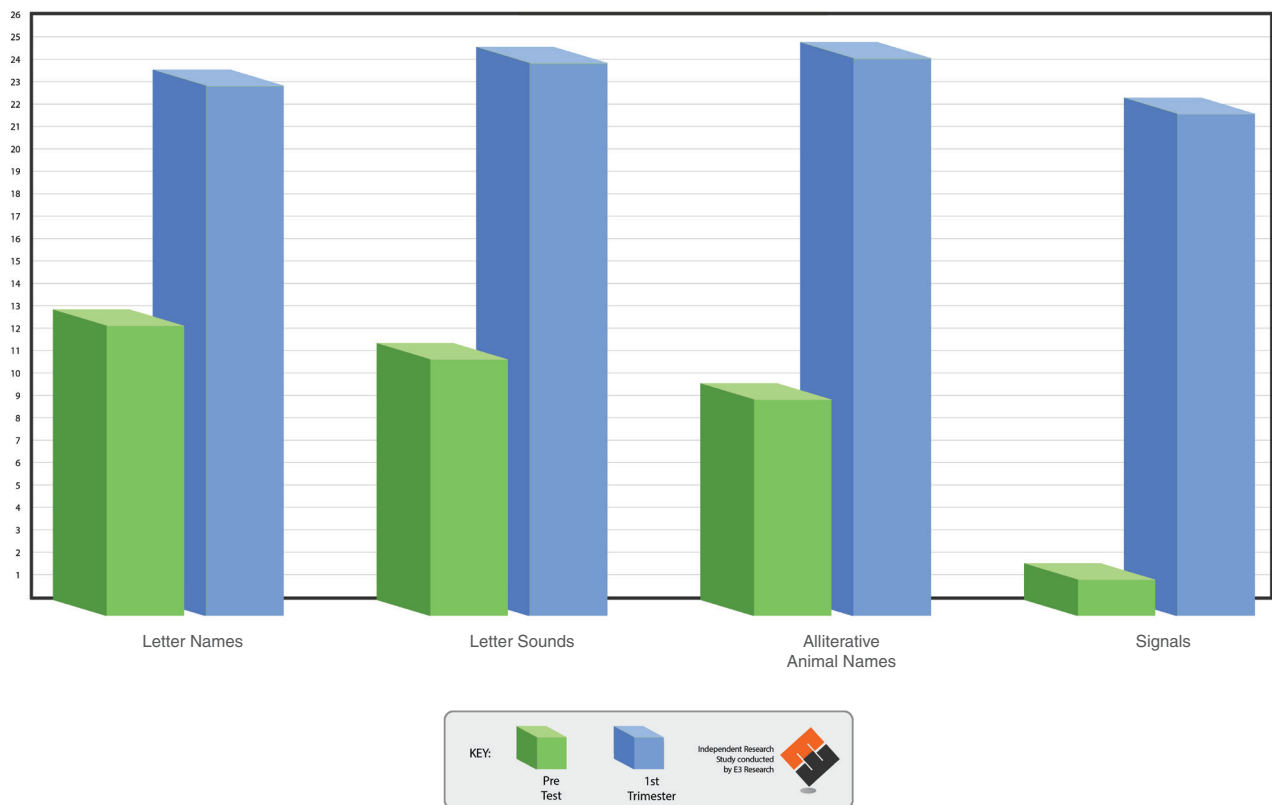
Alliterative Animal Names

The Alliterative Animal Names teach the sounds of both *Zoo-phonics* lower- and uppercase alphabet and help children learn both quickly. Student scores were nearly identical in the Pre-Test and Post-Test assessments for lower- and uppercase letters. In both cases, the mean gain scores of 15 indicated significant growth during the year.

Signals

The Body Signals are the same for both of the *Zoo-phonics* lowercase and uppercase alphabets. An additional Signal, a “salute,” is given to designate the capital letter. Uppercase Signals, Alliterative Animal Names and letter sounds are learned at the same rate as the lowercase alphabet. From the Pre-Test to the Post-Test, a significant gain of 20 Signals was made.

Graph 15 - Uppercase Alphabet



Uppercase alphabetic knowledge showed significant growth in letter names and sounds during the 1st Trimester of the year. The use of the *Zoo-phonics Capital Large Animal Alphabet Cards*, Alliterative Animal Names and Signals support and reinforce this new knowledge and showed even greater gains than names and sounds. Students had achieved near-mastery of all uppercase letters and sounds as well as Alliterative Animal Names and Signals within the first three months of the school year.

Table 3 - Gain in Alphabetic Principles

Gains from Pre-Test to 1st Trimester	
Uppercase Sounds	13
Uppercase Alliterative Animal Names	15
Uppercase Signals	20

Table 3 and Table 4 demonstrate the gains in uppercase alphabet skills during the 1st Trimester. Because the *Zoo-phonics Large Animal Alphabet Cards* and the *Zoo-phonics Capital Large Animal Alphabet Cards* share the same Animals, Alliterative Animal Names, and Signals, learning the uppercase letters is easy. Notably, mean scores for uppercase information in all skill areas show a large gain and are consistent with the lowercase mastery at the time of the Post-Test assessment.

Table 4 - Alphabet Skills Gains and Significance

Test	Number of students	Pre-Test Mean	Post-Test Mean	Significance $p \leq 0.05$.
Lowercase Name	292	11.53	23.52	.000
Letter Sound	292	11.37	24.88	.000
AA Name	272	9.51	24.54	.000
Signal	272	13.50	25.08	.000
Uppercase Name	289	12.87	23.41	.000
Letter Sound	289	11.15	24.55	.000
AA Name	271	9.47	24.74	.000
Signal	271	1.40	22.26	.000

Proficiency

Proficiency levels were established as a percentage scored compared to the maximum possible points. While these are not benchmarked, each test indicates that students in kindergarten had developed skills beyond alphabets. The tests used in Table 5 scores are grade-level assessments. Because these students progressed further than the *PALS-K* and *STAR* testing goes for the kindergarten level, **1st grade reading tests were necessary**. Consequently, scores may appear somewhat low because these kindergarten students were working at the first grade level. Every test shows significant growth. The evidence clearly indicates positive skill development in sound blending, reading, fluency and comprehension.

Table 5 - Year-End Proficiency Levels

Test	Score	Maximum	
Sound Blending or Reading VC/CVC Words, Phrases and Sentences	22.48	32	70.25%
Sound Blending or Reading VC CVC Words, Phrases	17.21	27	63.74%
Reading Paragraphs	47.58	132	36.05%
Comprehension	4.34	12	35.83%

Benchmarks

Three assessments were used in this study: *PALS-K*, *STAR* and *Z-BRA3*. *PALS-K* was designed as a diagnostic instrument and intended to identify students who may require intervention. It is administered and scored twice in a school year as a Pre- and Post-Test. While it does identify students who may require intervention, it is not stratified for reporting multiple levels of proficiency. The *STAR Early Literacy Instrument* sets benchmarks and five levels of achievement in order to identify high performing and low performing students. Lastly, the *Z-BRA3* was used to assess skills in the alphabetic domain in the fall and reading and comprehension in the spring. Reading and comprehension are frequently not assessed until 1st grade or later. The *Z-BRA3* is used to measure proficiency but does not set benchmarks.

PALS-K Benchmarks

PALS-K was the primary instrument used in the study. Kindergarten students were divided into roughly two groups in the beginning of the school year. Above the *PALS-K* fall benchmark were 53% of the students, while nearly 47% were below. The benchmarks used by *STAR* indicated 75% below the benchmark with only 25% at or above. Benchmark scores were compared with fall and spring data. The benchmark was reached by 53% of the students in the fall with a significant gain up to 82% in the spring.

Students who scored below the benchmark declined from 46.6% (149 students) at the beginning of the year to 16.3% at the end of the year. By the end of the school year nearly one third of the students in the study had moved from “below benchmark” to “above benchmark,” leaving 52 students identified as still needing additional support. This improvement indicates that early literacy proficiency increased significantly when the *Zoo-phonics Program* was used.

PALS-K specifically identifies students who may need early interventions and sets the benchmark intentionally low. *STAR* uses a broader range of groupings so students may be identified in one of several categories above and below the benchmarks. By the end of the school year, *PALS-K* reporting indicated a significant reduction in the number of students below the benchmark from 47% to 16%. This is generally consistent with changes in *STAR* results that reported 67% above and 33% below the benchmark at the end of the school year. While slightly different benchmarks were used in the two assessments, both show a consistent and significant pattern of positive growth in kindergarten reading skills for nearly all students in the study.

Table 6 - PALS-K Task Requirements and Benchmarks, Year-End

Test	Mean Score	Spring Benchmark	Maximum	% Proficient (Benchmark)	% Proficient (Maximum)
Group Rhyme	8.68	9	10	96	87
Beginning Sounds - Group	8.90	9	10	99	89
Lowercase Alphabet	25.16	24	26	105	97
Letter Sounds	23.68	20	26	118	91
Spelling	18.13	12	20	151	91
Pointing	3.76	5	5	75	75
Word ID	7.18	9	10	80	72
COW Word List	5.14	7	10	73	51
Pre-Primer List	14.39		20		72
Primer List	6.16		20		32
1st Grade List	1.45		20		7

The Task Requirements and Benchmarks (Table 6) table indicates that in 5 out of the 8 assessment tasks, students met or exceeded the *PALS-K* benchmarks. In Spelling, the mean score was 150% of the benchmark, while lowercase alphabet and letter sounds were also above the Benchmarks. Pointing, Word ID and the Concept of Word (COW) List were slightly below the benchmarks. The Concept of Word List showed moderate scores with a mean score of 5 out of 7. When viewed as a composite score in the Kindergarten-Summed score, an overall strong growth of nearly 80% proficiency level was attained. For the first year of implementation of both the *Zoo-phonics Program* and the *PALS-K Assessment*, this showed a strong performance that should improve incrementally over the next 3-4 years, especially with preschool students entering kindergarten who will have strong *Zoo-phonics* alphabetic skills than the current study group.

Table 7 - PALS - Kindergarten-Summed scores – Proficiency

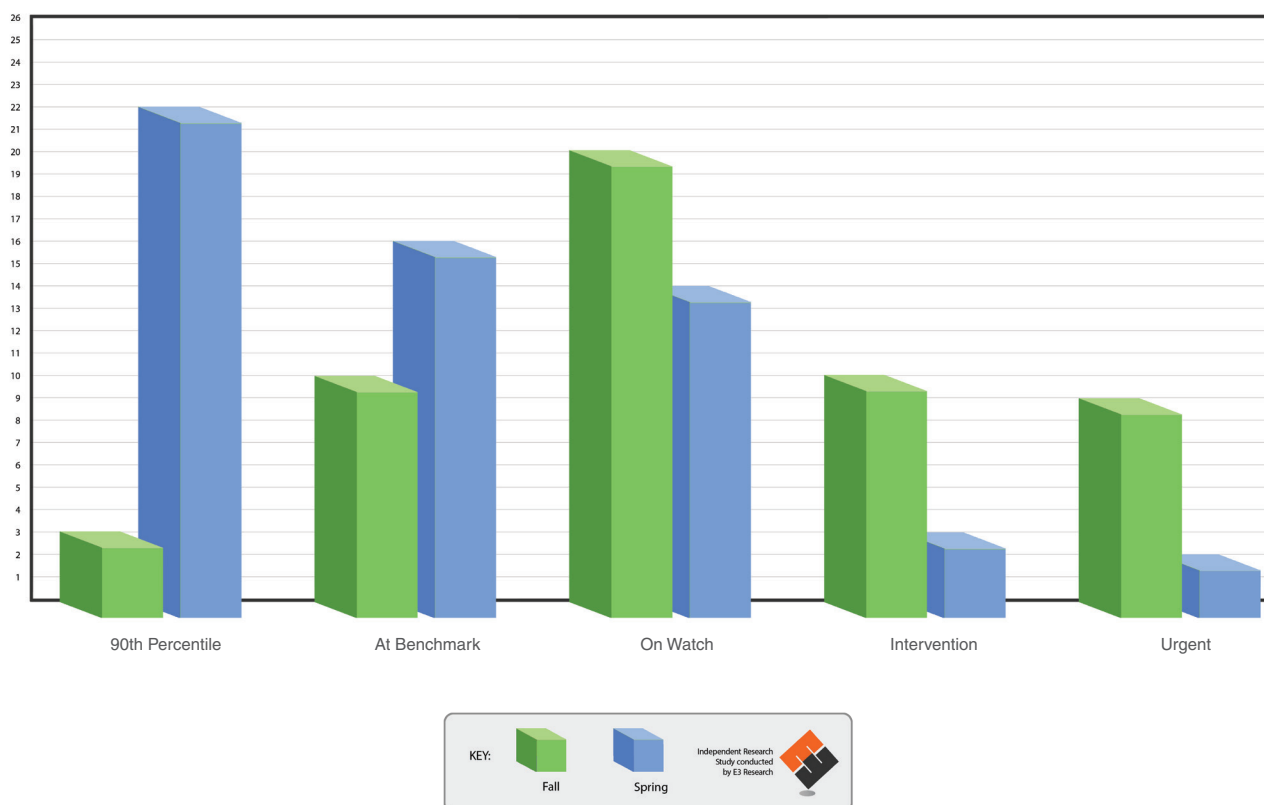
Fall	Spring	Maximum
28	81	102
28% Proficient	79% Proficient	

The Kindergarten-Summed Score is a composite score that indicates overall growth between the Pre- and Post-Tests. The Kindergarten-Summed Score is not benchmarked, but when viewed as a proficiency level measured against the maximum possible scores, significant growth was evident with a year-end mean proficiency level of 79%.

STAR Benchmarks

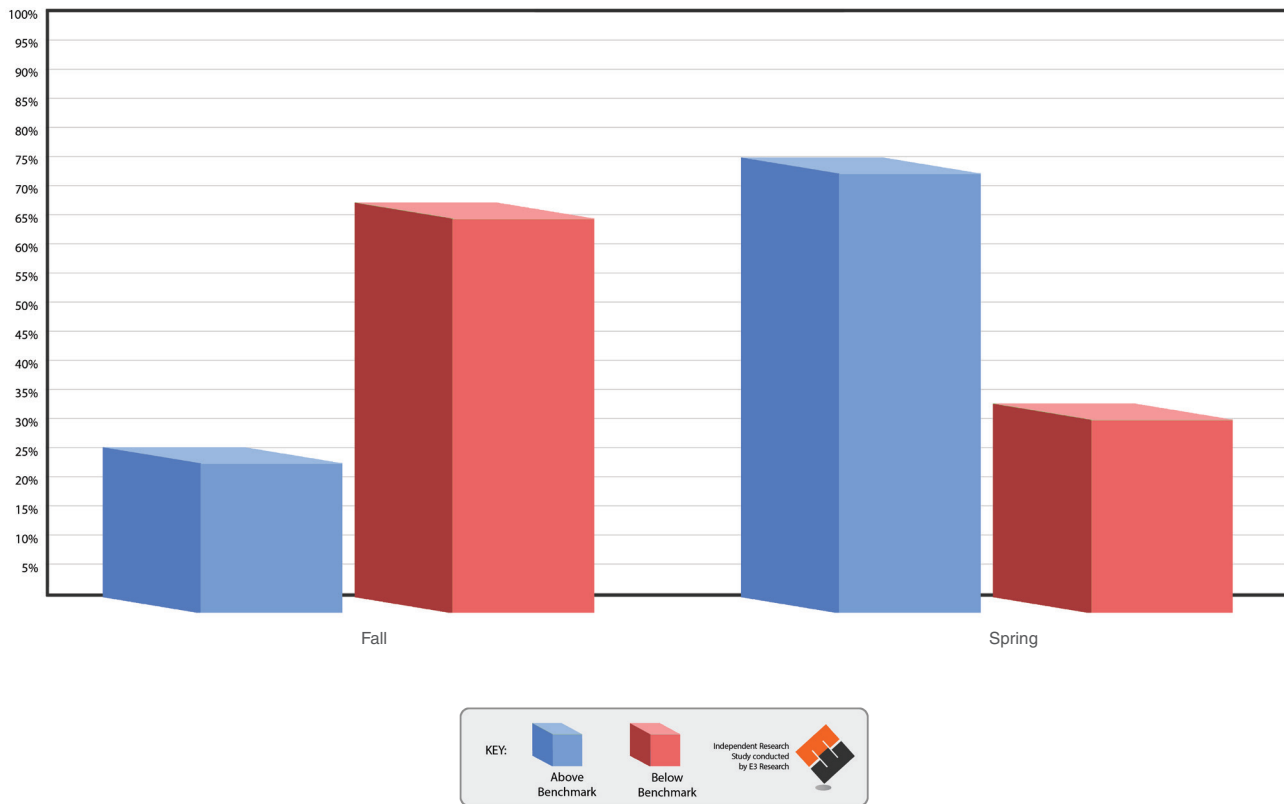
STAR assessments indicated that significant differences existed between the six elementary schools in the study. Initial “above-fall benchmark” percentages ranged from 19% to 40%, depending on the school. Mean scores showed that all schools in the Ohio County School District showed that 60% to 81% of the students entered kindergarten below the fall benchmark. By the end-of-the-year, 53% and 94% of the schools were at or above the spring benchmark. Conversely, the below-benchmark percentages ranged between 6% and 47%, depending on the school, which shows a significant improvement.

Graph 16 - STAR Screening Levels – Fall vs. Spring



Overall, at the beginning of the school year 25% of the kindergarteners were at or above the fall benchmark. 75% of the students were identified as being below the benchmark and in need of interventions. By the end of the school year, 67% of the students were at- or above- the spring benchmarks while 33% remained below. During the school year, the greatest improvement occurred in the middle group of students who moved from the “On Watch” category to the “At Benchmark” category. Students in the “Intervention” and “Urgent” categories also moved up, reducing the numbers of students needing directed support significantly.

Graph 17 - *STAR* Scores Above and Below Benchmarks



Conclusions

The purpose of this study was to determine the efficacy of the *Zoo-phonics Multisensory Language Arts Kindergarten Program* in authentic kindergarten classrooms in rural Kentucky.

Research Question 1

Do kindergarten students receiving the *Zoo-phonics Multisensory Language Arts Program* demonstrate significant growth in reading skills outcomes (alphabetics, reading fluency, comprehension)?

Conclusion #1:

Students receiving the *Zoo-phonics Multisensory Language Arts Program* showed significant growth as demonstrated by consistently significant gains between Pre- and Post-Test scores in all three assessments.

PALS-K:

The K-Summed score showed an overall improvement in proficiency from 28% in the fall to 79% in the spring.

Z-BRA3:

By the end of the first trimester, mean scores had reached a near-mastery level for lowercase letters (23/26), sounds (24/26), uppercase letters (23/26) and sounds (24/26).

STAR:

Only 25% of the students were above the fall benchmark, which increased significantly to 67% by the end of the year.

Conclusion #2:

Students showed strong growth in reading fluency and comprehension. The *Z-BRA3* tests for Alphabetics, High Frequency Words, Sound-blending, Reading and Comprehension. All showed strong skills development by the end of the school year. Using the test administered to 1st graders, proficiency levels were:

High Frequency Words – 70%

Sound-blending - 66%

Reading - 36%

Comprehension – 36%

This demonstrates strong skills development in fluency skills but, more importantly, in understanding of what is being read.

Conclusion #3:

Kindergarten students should perform significantly better in 1st grade than their predecessors. The students in this study developed high levels of alphabetic, fluency and comprehension skills during kindergarten. As a result, nearly all students will be entering 1st grade with strong foundational skills, allowing them to read earlier and with greater proficiency than their predecessors.

Research Question 2

Are there differences in alphabetic skill levels between sub-groups (low SES, genders) after receiving *Zoo-phonics Multisensory Language Arts Instruction* as measured by the *Z-BRA3* and *PALS-K*?

Conclusion #1:

There was no significant difference in scores among genders. With a 50%/50% ratio, boys and girls performed equally.

Conclusion #2:

Socio-economic status (SES) was not a factor in student performance. Low SES students dominated the study group and with significant gains reported across all students, no difference was evident among SES groups.

Research Question 3

Do students who have received the *Zoo-phonics Multisensory Language Arts Program* reach benchmarks as established by *STAR* and *PALS-K*?

Conclusion #6:

Students who received *Zoo-phonics* instruction showed significant gains in alphabetic, fluency and comprehension skills.

PALS-K:

The Task Requirements and Benchmarks Table (Table 6) indicate that in 5 out of the 8 assessment tasks, students met or exceeded the *PALS-K* benchmarks. When compared to the benchmark score in each category, proficiency levels range from 73% to 151%. The K-Summed score indicated an increase in proficiency from 28% in the fall to 79% in the spring. This is not benchmarked but does reveal a significant gain in proficiency of 51%.

STAR:

Students showed significant gains between fall and spring. The *STAR* scores for fall indicated that only 25% of the students were at or above the benchmark. By the end of the spring term, 76% of the students were at or above the benchmark. The number of students below the benchmark was reduced dramatically in all three categories, especially the two lowest levels, "Intervention" and "Urgent."

Summary

The overall conclusion that can be drawn from this study is that kindergarten students using the *Zoo-phonics Multisensory Language Arts Program* gained mastery in alphabetic skills and gained significantly in fluency and comprehension and overall general reading achievement. Students made significant gains in reaching benchmarks on two widely used instruments.

Subgroups within the study performed equally with the overall population. Considering that the majority of students in the study are considered "low economic status," their gains are significant. The results of the study are gender-neutral. Boys and girls performed equally, and students with low SES performed as well as all other students in the study.

The students in this kindergarten study are expected to out-perform their predecessors in 1st grade as a result of stronger and more advanced literacy skills that were developed in kindergarten. The *Zoo-phonics Multisensory Language Arts Program* helped students achieve significant gains in early literacy skills and our conclusion is that the program is efficacious when used with fidelity.



An Independent Study Conducted by E3 Research

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