

## ***Headsprout Early Reading™: Reliably Teaching Children to Read***<sup>1</sup>

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Reading proficiency is a crucial foundation for success in all academic areas, yet we are a nation faced with a reading crisis. Four in ten children have literacy problems, and over 40% of our nation's fourth graders score below basic reading levels (National Center for Learning Disabilities, 2001). Learning to read is a formidable challenge for more than 50% percent of our nation's school children (Lyon, 1998), and parents spend billions of dollars each year on extracurricular books, software, tutors, and other reading aids. Teachers and schools face the challenges of finding the best teaching method, implementing these methods in large classrooms, and accommodating students' widely varying abilities and readiness. Despite the time and money spent on solving the reading difficulties of our nation's children, the problems aren't disappearing. Headsprout, a Seattle-based applied learning sciences company, has been working on a solution that bridges the efforts of parents, schools and agencies with the goal of preparing children for success in any core reading program chosen by a teacher, school, or school district.

Headsprout spent over four years in a major research and development effort to build a beginning reading program that incorporates principles derived from the scientific investigation of early reading (see for example Rayner et al, 2002) with principles derived from the experimental and applied analysis of behavior. The result is a highly effective beginning reading program available to all children over the Internet.

*Headsprout Early Reading™* is a new engaging, Internet-based reading program that effectively teaches the essential skills and strategies required for rapid reading success. Experienced educators and learning scientists leveraged years of classroom experience and scientific research in developing the product. The program was extensively tested with thousands of children, who produced millions of data points that were collected and analyzed at a cost of millions of dollars in order to research, develop, test, and refine the program (see Twyman et al, in press). On the surface the program appears to the child as an interactive cartoon. Children learn essential reading skills through multiple interactions with engaging, cartoon-based episodes set in the entertaining environs of Space World, Dinosaur World, Undersea World, and Jungle World. Underneath is a sophisticated, patented technology, designed by experienced educators and learning scientists, that systematically teaches the phonics skills and comprehension strategies necessary to sound-out words and read with understanding. Every aspect of the program from instructional design, to performance outcomes, to ease of use and learner motivation has been

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<sup>1</sup> This manuscript was the basis for a shorter article, "Inside *Headsprout Early Reading*," that appeared in the Fall 2003 edition of the *Current Repertoire*, Newsletter of the Cambridge Center for Behavioral Studies; it also draws upon and includes text from an upcoming book chapter by the authors: Selected for success: How Headsprout Reading Basics™ teaches beginning reading, to appear in D. J. Moran & R. Malott (Eds.) *Empirically supported educational methods*, St. Louis, MO: Elsevier Science/Academic Press. Which is available from Elsevier/Academic Press ([www.elsevier.com](http://www.elsevier.com)).

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extensively researched, reviewed and refined (after Neuman & McCormick, 2002; Sidman, 1960). The program has been so rigorously developed that Headsprout offers schools a full refund of the price of the product for each Kindergarten or 1<sup>st</sup> grade student who is not at or above grade level upon completing the Early Reading program.

### **Key Skills and Strategies: The building blocks of reading success**

Although phonics instruction has drifted in and out of favor in the educational establishment, a large body of research points to its essential role in the process of teaching children to read. In April 2000, the Congressionally mandated National Reading Panel reported that early systematic phonics instruction improves children's reading and spelling abilities (National Institute of Child Health and Human Development, 2000). Research also suggests that the absence of explicit instruction in phonemic awareness and phonics can cause learning problems that put learners at a permanent educational disadvantage unless they are corrected by the end of the third grade (National Reading Panel, 2000).

The Public Library Association (n.d.) points out that "research has shown that there is nearly a 90% probability that a child will remain a poor reader at the end of the fourth grade if the child is a poor reader at the end of first grade." The research suggests that Headsprout's approach of explicit instruction in phonemic awareness, phonics, and a strategy for sounding out words can prevent many children from developing learning problems and can give almost all children an equal opportunity to become good readers. When Headsprout children arrive at school, they will be prepared no matter how large or small the role phonics plays in their classroom. *Headsprout Early Reading* is a teacher's ally (not a teacher's replacement), giving students a boost in essential skills and raising the likelihood of reading success in a busy classroom, or before formal classroom instruction even begins.

Research has identified five basic, interconnected sub-skills that all children must master if they are to become proficient readers (The National Right to Read Foundation, n.d.), all integral to *Headsprout Early Reading*. First, beginning readers must develop what is called phonemic awareness—the recognition that all words are made of separate sounds, called "phonemes." Second, beginning readers also need to learn phonics, which is the ability to link these sounds to the specific letters or combinations of letters representing them in written language. This association between letters and sounds must become fluent so that learners can decode words almost instantly. Beginning readers must learn a strategy to sound out the sequence of phonemes in a word and blend the sounds back together to read whole words. Third, a learner's spoken vocabulary must be extended to become a reading vocabulary. They must understand that the words they read have meaning just as do the words they say. Further, they should come to understand that words they read have meaning even if they have not yet encountered that meaning. Fourth, reading fluency is important to reading success. Fifth, comprehension of what is read is essential. The seeing and saying of words, although essential, is not sufficient to create a good reader. Children must understand what they read, and be able to act on that understanding.

*Headsprout Early Reading* tackles these five important features in the following way:

**Phonemic Awareness** — Phonemic Awareness instruction is integrated throughout many of *Headsprout Early Reading's* teaching routines. Learners hear letter sounds in order to select visual stimuli, and then hear them again as confirmation of selections. Learners are asked to say the sounds and then listen to cartoon characters say sounds, and then select the character that "said the sound just like you did." Learners put the sounds together, hear them slowly blended, say them slowly blended, and then hear the sounds said fast as whole words, and eventually say the words fast. They learn to not only identify and say the sounds letters make, both independently and as blended units, but to listen to and identify the sounds they say, a critical step in becoming a speaker as own listener.

**Phonics** — In *Headsprout Early Reading* children learn 110 carefully chosen phonetic elements, most of which maintain a consistent pronunciation in nearly 85% of the words in which they appear. This early consistency is extremely important to ensuring the transfer of segmenting and blending skills learned in the program, to words encountered outside the program. This allows the natural outcome of reading in a social environment to become the critical consequence for reading.

*Headsprout* has addressed learner and teacher concerns about the rule-filled, exception-filled English language. Too often, learners are expected to begin reading by memorizing rules that dictate sound/letter associations only to have to memorize further exceptions to those rules. The English language uses the 26 letters of the alphabet to represent 44 sounds - sounds that can be written in over 400 different ways. To untangle this confusing web for the beginning reader, *Headsprout Early Reading* begins with very consistent letters and sounds, such as "ee," "v," "cl" and "an." As noted earlier, the sounds in *Headsprout Early Reading* are stable (read the same way), greatly increasing the likelihood of learners reading the word correctly.

With *Headsprout Early Reading*, learners gain confidence early in their ability to sound out without being distracted by the challenge of memorizing the English language's many vagaries. By using one, two, and three letter combinations learners find that sounds can be combined to make meaningful units of phonemic information. Further, learners quickly discover that some sounds can have other sounds inside them and that sound units can be combined to make new sounds. *Headsprout Early Reading's* instructional strategies result in learners reliably "adducing" these insights in a discovery-learning environment, rather than having to be directly taught. They learn to use their phonics knowledge for sounding-out words in isolation, as parts of sentences, and when reading stories with words they have not been directly taught.

**Vocabulary Development** — *Headsprout Early Reading* provides a critical foundation for early vocabulary building, particularly as it affects reading. An essential component of vocabulary growth is the concept that words are made of sounds, that when put together, have meaning. *Headsprout Early Reading* teaches that words have meaning, and that they make sentences that, in turn, make stories. Learners begin to add words that are likely to be in their spoken vocabulary to their reading vocabulary as they sound out new words and learn selected sight words. Through the use of character names, they learn that words

they may have never before encountered have meaning as well. More phonetic elements are added as the initial sounding-out strategies are learned; the words made from the elements are practiced to ensure that they become a permanent part of the learner's vocabulary. Once the sounding-out skills are firm and all 110 phonetic elements taught, a typical learner would, in less than 30 hours of instruction, have a potential reading vocabulary of over 5000 words.

**Reading fluency, including oral reading skills** — Fluency is a critical element to all Headsprout Early Reading activities. Often, fluency work is left to the end of the reading process, when a learner practices reading sentences. Headsprout understands that fluency at the component skill level is critical to fluency at the composite skill level (Johnson & Layng, 1994; LaBerge & Samuels, 1974; Samuels & Flor, 1997). From as early as lesson one, learners engage in fluency building activities for finding sounds in words. By lesson 4, learners are building fluency on words made up of the sounds they have learned in the previous lessons, and by lesson 5, learners read their first story. Soon, learners are practicing reading entire passages in carefully designed fluency activities. In the 80 lessons that comprise Headsprout Early Reading, over 50 fluency-building opportunities have been specifically designed to build a strong reading repertoire. In fewer than 30 hours of instruction a learner will have read 80 separate stories. Most of the stories are designed for learners to read independently. These stories include narrative and expository text as well as poetry; they begin with as few as three sentences and grow to include chapter books.

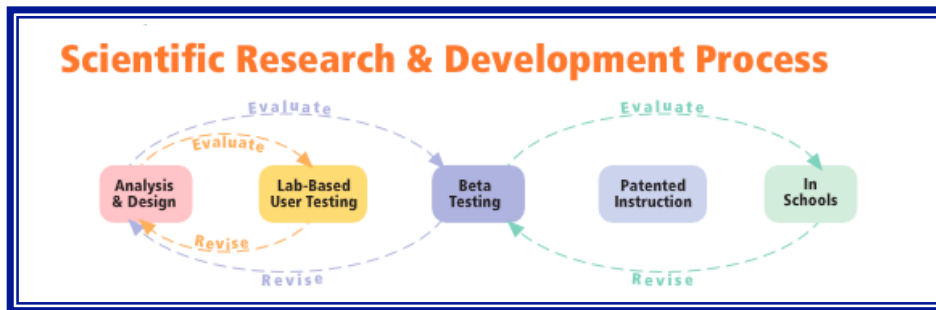
Some early stories are to be read with someone else, such as a parent. These stories are more complicated, punctuated with sentences learners can easily read. Learners, thereby, are exposed to fluent reading at a higher level than they can currently handle, and must pay close attention so they can read "their" sentences when it is their turn.

**Reading comprehension strategies** — An article about beginning reading began with the following observation (paraphrased): If "Look at the ceiling" is written on a black board, and a person says, 'look at the ceiling,' the person is decoding, if the person's head tilts back and a glance upward is observed, the person is comprehending (Goldiamond & Dyrud, 1966). Though overly simplified, it emphasizes the important point that the evaluation of comprehension requires indicator responses that are separate from simply seeing and saying words or sentences. These indicator responses are key to teaching and evaluating comprehension. Accordingly, Headsprout Early Reading employs frequent use of comprehension indicators to test whether what is being decoded is also being understood. Carefully designed indicators are used to teach self-observation as well as sentence and story comprehension. After each reading exercise, learners must choose one of three pictures that go with the sentence. The pictures vary in such a way as to ensure that the words in the sentences have been read and are understood. From as early as lesson 5, learners understand that the sentences they read are not simply lists of words, but units of meaning. Learners then transition to continually more challenging comprehension activities, including: selecting pictures that represent meaning derived from whole stories, constructing meaning by building sentences that result in an animated picture that represents the sentence, expressing meaning by building sentences that describe a picture, completing sentences that best describe a picture by selecting a missing word from four alternatives, and reading a text passage and selecting the best answer to a written question from among three written alternative answers.

## **Rigorous Formative Evaluation: Ensuring the Success of Technology Transfer**

Whereas these essential features of successful reading instruction are often said to be included in many reading programs, the ways in which the skills, which ultimately define these features, are taught, are not so well defined, nor are they tested. Whereas many programs claim to be “based on research,” the precise meaning is often left to the reader’s interpretation, and many do not mean it in the sense of a program that is developed and tested through rigorous research protocols (Layng, Stikeleather, & Twyman, in press; Layng, Twyman, & Stikeleather, in press; Twyman, Layng, Stikeleather, & Hobbins, in press). Often it is a statement of content; that is, the program includes practices that earlier research has shown to be effective, but the program itself has not been so tested.

In contrast, Headsprout scientists and instructional designers employed scientifically derived instructional principles drawn from both the basic and applied learning sciences, and a rigorous, control–analysis formative evaluation process throughout the development of the product. A description of the formative evaluation process and the instructional approach taken by Headsprout has been described elsewhere (Layng, Stikeleather, & Twyman, in press; Markle, 1967; Markle & Tiemann, 1967; Twyman et al, in press). Briefly however, the process followed that described in Figure 1.



**Figure 1. Graphic representation of the iterative control–analysis instructional development process used by Headsprout.**

First, a content analysis was performed (after Tiemann & Markle, 1991; Twyman et al, in press) to determine the precise objectives toward which the program would be directed, and the instructional strategies needed to achieve those objectives. Second, as each instructional activity and then lesson was designed learners tested it in our laboratory. If the learners had difficulty with the lesson, it was revised until almost every new learner was successful with that activity. Our standard for most activities was 90% of learners achieving 90% correct on the activities and meeting rigorous exit criteria. For example, learners had to pick out a letter based on its sound from other topographically similar letters that changed from trial-to-trial with 5 consecutive corrects (no errors). Since mastery criteria are used, no learner can proceed to the next activity until the mastery criteria are met. Accordingly, percent correct reflects the amount of

instruction required to meet the final mastery exit criteria rather than an overall score reflecting level of mastery.

The objective of the control–analysis development strategy was to ensure that each learner met the individual mastery criteria, and reduce the variability in responding between individual learners such that we could state not only what the criteria were, but that nearly all learners would meet them. For example, Figures 2, 3, and 4 show the effect of the design, test, revise, test, control–analysis approach to controlling variability. The figures depict total opportunities to respond, responses, and correct responses for different learners completing Episodes 2 during the course of development. Upon initial episode testing we determined that we needed to increase the response opportunities, and reduce the variability between learners for all categories. Changes were made in the activities that comprise the episode and tested. Variability between learners, as shown in Figure 3, actually increased. Further revisions were required which ultimately led to the stability depicted in figure 4. Figures 5 and 6

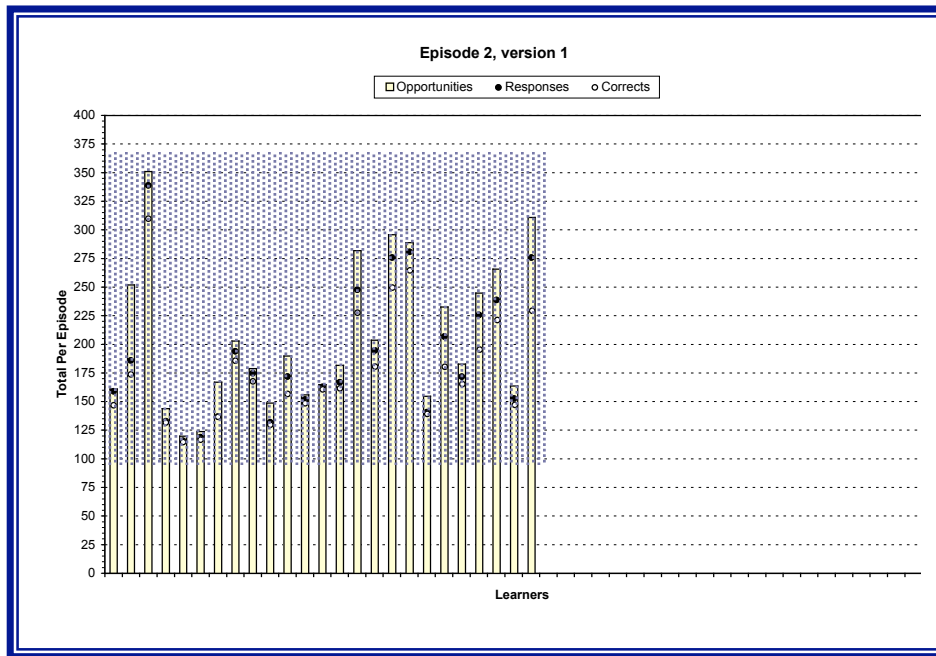


Figure 2. Variability in responding between learners in Episode 1 version 1.

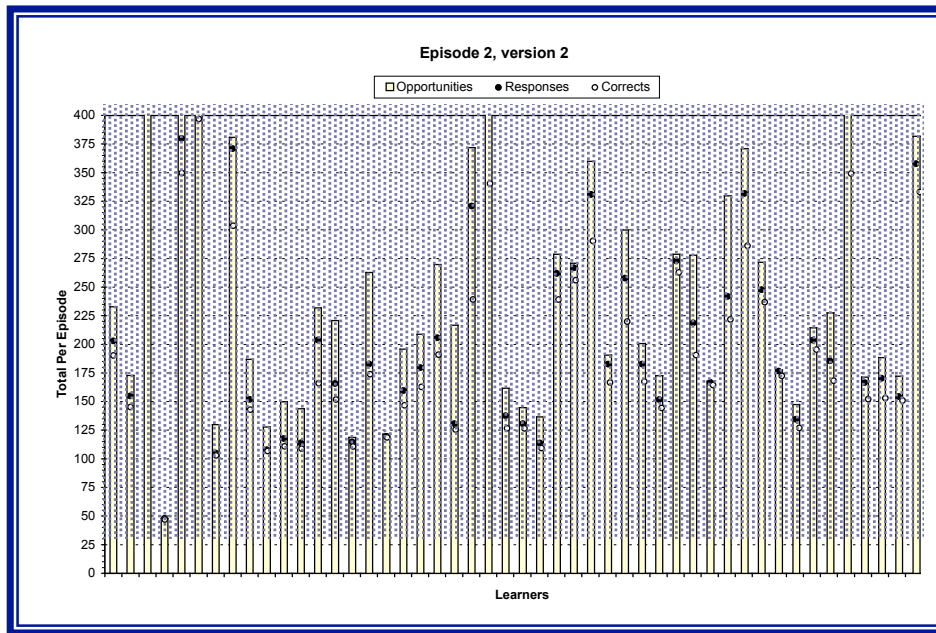


Figure 3. Variability in responding between learners in Episode 1 version 2.

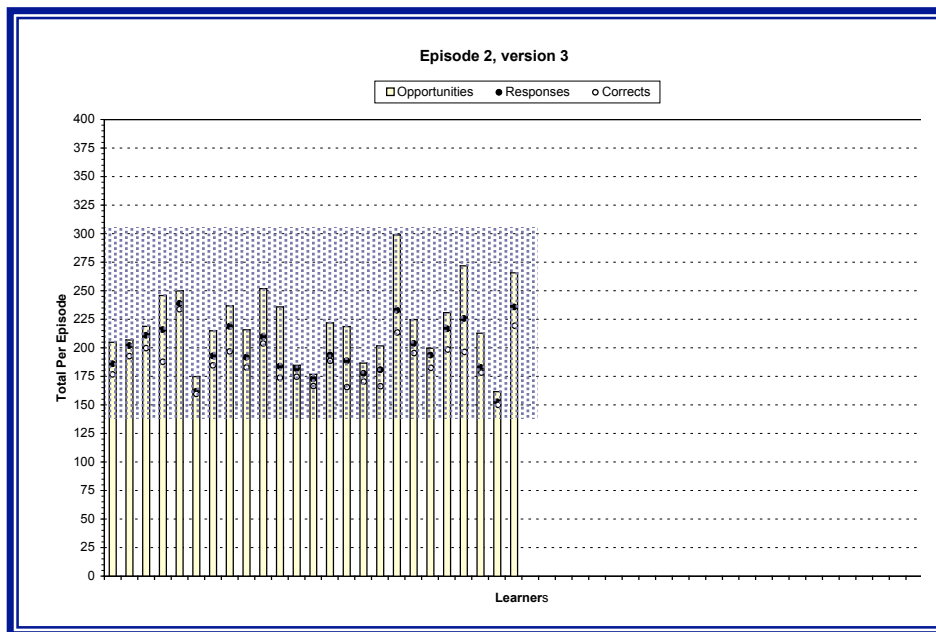


Figure 4. Variability in responding between learners in Episode 1 version 3.

show another example of program revisions that led to stable, predictable, responding by each individual completing Headsprout Early Reading Episode 17.

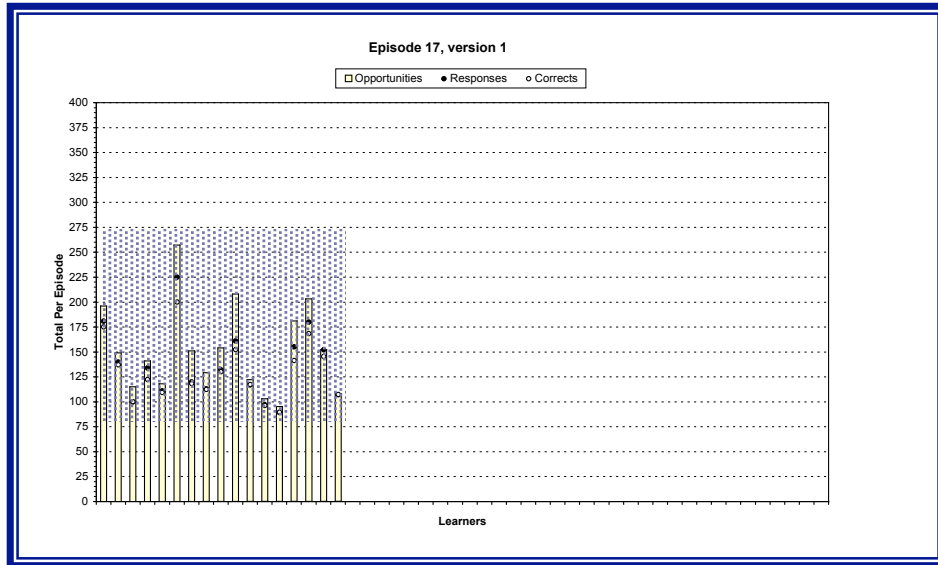


Figure 5. Variability in responding between learners in Episode 17 version 1.

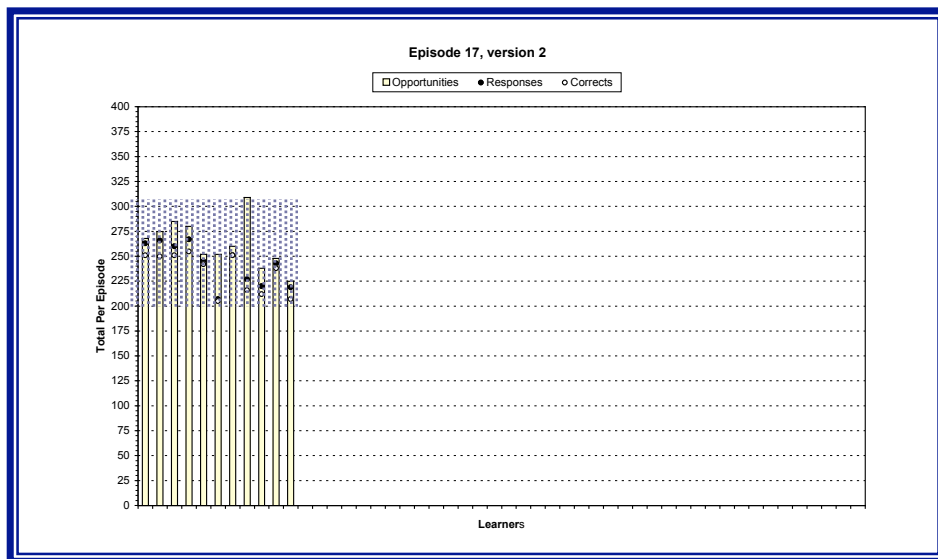


Figure 6. Variability in responding between learners in Episode 17 version 2.

Third, once the developmental testing was completed the program was tested on a larger scale over the Internet to ensure the validity of the developmental test data. Over 1000 learners participated in this phase. Over 90% of the learners achieved over 90% correct per each Episode for the entire program. This validation testing set the occasion for further revisions. Fourth, tests were conducted in schools. Data from those tests confirmed the developmental test data and are reported in Layng, Twyman, and Stikeleather (in press). Thousands of data-based program revisions were made over the course of development. This process culminated in an instructional methodology we call Generative Learning Technology, which was issued a U.S. Patent in 2003 (No. 6,523,007).

Our goal for the entire 80-lesson Headsprout Early Reading program was to produce learners who consistently score at or above grade level, and produce Kindergarten children with reading skills typical of a mid-second grade learner. Standardized test outcome data from 16 initial completers suggest we have accomplished this goal (see figures 7, 8, and 9). Eight had completed Pre-K and were entering kindergarten, the other eight completed kindergarten and were entering first-grade. Further school-based summative evaluation studies using randomized-control procedures are currently underway.

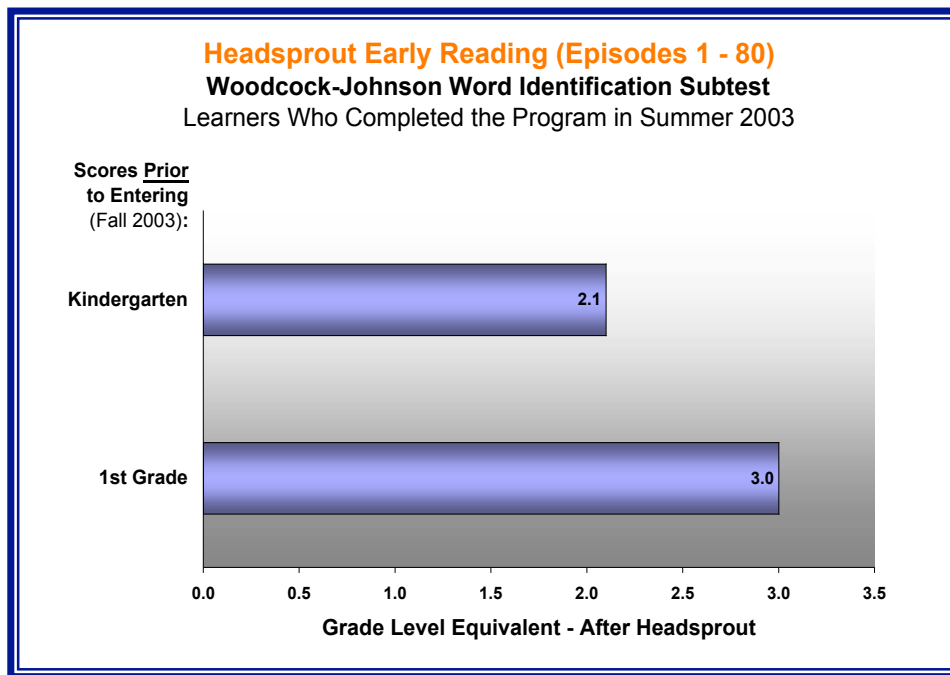


Figure 7. Outcome scores for 8 Pre-Kindergarten and 8 Pre-1<sup>st</sup> Grade learners

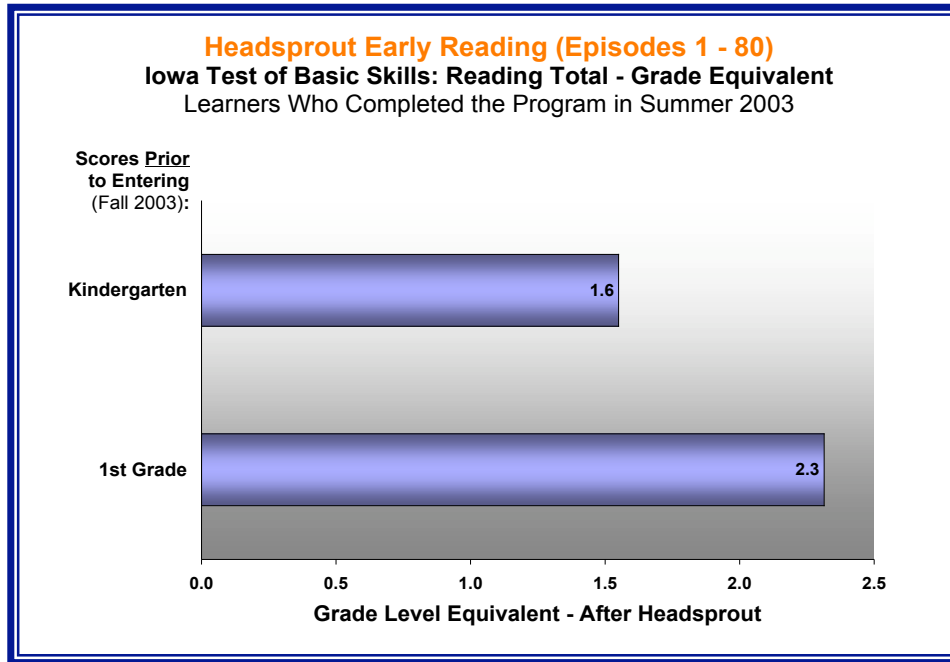


Figure 8. Outcome scores for 8 Pre-Kindergarten and 8 Pre 1<sup>st</sup> Grade learners.

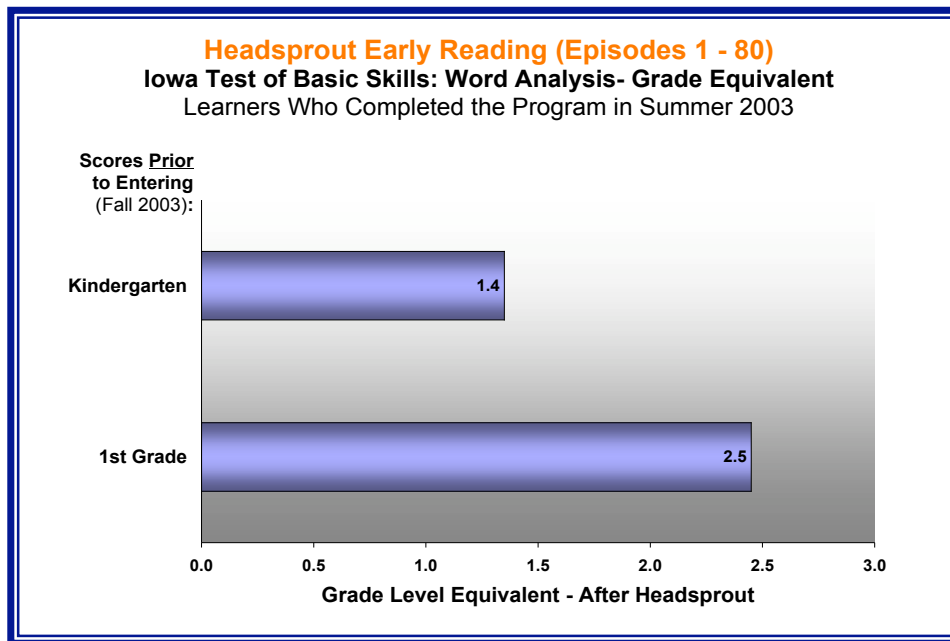


Figure 9. Outcome scores for 8 Pre-Kindergarten and 8 Pre-1<sup>st</sup> Grade learners

*Headsprout Early Reading* offers a truly balanced approach to beginning reading instruction that shrinks the chasm between phonics traditionalists and advocates of literature-based reading instruction. While it has its foundation in teaching learners to identify letter-sound combinations and combine them with other letter-sound combinations, its emphasis on comprehension incorporates elements that do not appear in many phonics programs, and prepares children for lifelong reading success. Headsprout Early Reading represents a fundamental example of a technology transfer process that combines the scientific study of reading and the experimental analysis of behavior, with lessons learned from instructional systems design, the applied analysis of behavior, and practical classroom teaching. All of which produced an effective and reliable technology that was shaped into a comprehensive instructional program through a rigorous formative evaluation, performed in large part by those for whom it was designed –the children themselves.

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