Selected for Success: How Headsprout Reading Basics™ Teaches Beginning Reading

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Section I

Selected for Success: How Headsprout Reading Basics™ Teaches Beginning Reading

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 nearly 3 years and $5 million in a major research and development effort to build a beginning reading program that incorporates principles derived from the scientific investigation of early reading with principles derived from the experimental and applied analysis of behavior. The result of this effort is Headsprout Reading Basics, a balanced, phonics-based reading program that teaches the skills and strategies necessary to sound out and read words. Delivered over the Internet, 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. Kids, parents, teachers, and learning scientists alike verify the effectiveness of Headsprout's methods in providing children with the skills they need to succeed in classroom reading instruction.

**Key Skills and Strategies: Students and Teachers' Best Friends**

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 Reading Basics 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 Reading Basics. 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 Reading Basics tackles these five important features in the following way:

1. **Phonemic Awareness** — Phonemic Awareness instruction is integrated throughout many of Headsprout Reading Basics' 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.

2. **Phonics** — In Headsprout Reading Basics children learn 34 carefully chosen phonetic elements that maintain a consistent pronunciation in over 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. 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 Reading Basics' 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.

3. **Vocabulary Development** — Headsprout Reading Basics 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 Reading Basics 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. 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 firmed and all 34 sound elements taught, a typical learner would, in less than 15 hours of instruction, have a reading vocabulary of over 500 words. Throughout the program exercises are provided that have learners match sentences made from their newly learned words to pictures of objects and actions to ensure that learners have a basic understanding of the words they are reading.

4. **Reading fluency, including oral reading skills** — Fluency is a critical element to all Headsprout Reading Basics activities. Often, fluency work is left to 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, 1992; 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. In the 40 lessons that comprise Headsprout Reading Basics, 38 fluency-building opportunities have been specifically designed to build a strong reading repertoire. In fewer than 15 hours of instruction a learner will have read twenty-three separate stories. Most of the stories are designed for learners to read independently, however, others 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 then they can currently handle, and must pay close attention so they can read "their" sentences when it is their turn.

5. **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 Reading Basics 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 five, learners understand that the sentences they read are not simply lists of words, but units of meaning.

Headsprout Reading Basics offers a truly balanced approach to beginning reading instruction that shrinks the chasm between phonics traditionalists and advocates of whole language reading instruction (see Rayner et al., 2002). While it has its foundation in teaching learners to identify letter-sound combinations and combine them with other letter-sound combinations, it incorporates elements that do not appear in many phonics programs. For example, Headsprout Reading Basics teaches children to read full sentences and stories and comprehend their meaning. Moreover, 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 Reading Basics begins with very consistent letters and sounds, such as "ee," "v," "cl" and "an." As noted earlier, the sounds in Headsprout Reading Basics are stable (read the same way) in over 85% of their occurrences, greatly increasing the likelihood of learners reading the word correctly. For example, a child who learns "ing" pronounced as it is in "sing" will be correct when using that pronunciation in 99% of other occurrences. With Headsprout Reading Basics, learners gain confidence early in their ability to sound out without being distracted by the challenge of memorizing the English language's many vagaries.
Section II

Learning Methodologies: Foundational and Flexible

Headsprout also derives its success from a methodology that incorporates four key pedagogical frameworks:

- Headsprout's carefully designed instructional sequence allows learners to start with things they know or can easily do and builds instruction from there. This enables learners to make fewer mistakes and reduces the frustration of trial and error learning. Errors that are made are used as teaching opportunities and the learner is always provided the opportunity to retry and succeed at the task.
- Headsprout Reading Basics allows children to practice and learn until they've mastered the skill. The program ensures that a learner does not exit an instructional segment without achieving the specific learning goal. For example, a learner may be asked to make five consecutive correct letter/sound discriminations. This might take one learner just 5 responses. Another may give some wrong answers, be diverted into a brief tutorial session, and then return to the initial task where five consecutive correct is still be required for exit. Learners that may have required more instruction or practice opportunities, still exit meeting the mastery criteria.
- Headsprout wants every learner to achieve fluency. For example, in a letter/sound discrimination task, fluency may be defined as the ability to consistently, quickly, and accurately identify sound and letter combinations. Fluency improves the retention of new skills, enhances the comprehension of new material, and facilitates the recognition of new words. This builds confidence and accelerates reading as a whole. When learners read words, time criteria are introduced such that word reading becomes more automatic. This is extended to sentence and story reading as well. Fluent oral-reading examples are provided as models and confirmation that emphasize both rate and prosody.
- Headsprout further improves the retention of fresh reading skills with its process of cumulative review. Skills-not pieces of information-are revisited, reused and extended. Children aren't merely memorizing information; they're learning the "hows" of reading which stick with them-just like riding a bicycle-even when there's been a significant period of no or little practice.

Headsprout's multifaceted methodology thus gives rise to instruction that is tailored to meet the needs of each learner-and ensures that those needs are met before the lesson comes to an end. The idea of continual adaptation-and evolution-influences Headsprout Reading Basics in many ways. Headsprout supports its reduced error program with moment-to-
moment adaptation based on each learner response. According to a learner's frequency and ratio of corrects and errors, click rate, or error patterns, the program immediately adjusts to offer the most beneficial lesson for that learner. Although the core of instruction is the same for everyone, some quick detours-reminders and review sessions (subroutines in the program)-are downloaded in the background, ready to pop up and provide extra skill building and reinforcement if needed. Headsprout is thus predicated upon a flexible constant: learners' overall experiences and session lengths can vary as their successes and errors vary, but all of them emerge from each episode having shown their acquisition of the same target skills. No one moves on to the next episode until he or she has successfully completed the one at hand.

In another example of adaptation, new approaches to teaching are continually tested against existing approaches. Methods that produce the greatest learner success are "selected," with those methods that are less successful dropping out. This commitment to learner testing helps ensure a continuous evolution of the program governed by learner success.

Nine teaching routines comprise the core of Headsprout Reading Basics. An overview of the instructional design process may be found elsewhere (Twyman, Layng, Stikeleather & Hobbins, in press), and greater elaboration and developmental data for each routine is being prepared for future publication, the nine routines may be summarized as follows:

• **Establishing Routines** rapidly teach a learner the initial phonetic and other sound/symbol components of reading. These routines establish sound/symbol guidance over a young speaker's verbal behavior, and transfer that control to textual stimuli, the decoding basis of reading. The careful sequence of specific component skills promotes the rapid acquisition of basic reading strategies. The establishing routine is unique in the way visual and auditory stimuli are presented and sequenced, and in the way learner behavior is confirmed or corrected. The establishing routine is also used to teach whole word reading when that is required.

• **Adduction routines** are a special subset of establishing routines that promote the rapid acquisition of new skills with little or no direct learner instruction (Andronis, Layng & Goldiamond, 1997). Environments are created that recruit elements of previously learned skills into new skill sets, obviating the need to build these new elements independently. Adduction routines have uniquely designed presentation, confirmation, and correction subroutines.

• **Vocal potentiation routines** (after Goldiamond & Dyrud, 1967) encourage learner-spoken behavior in the absence of an independent listener or voice recognition capabilities. The potentiating routine has uniquely designed
presentation, confirmation, and correction subroutines that bring learner spoken behavior under the guidance of textual stimuli and their own discriminative repertoire.

- **Blending and segmenting routines** teach the learner a strategy for using sound elements to decode a word. The strategy ultimately requires the learner to hold each sound in a word until the next sound is vocalized. Ultimately, the learner must say the "stretched" word quickly, as one would normally say the word. While this routine is similar to a strategy some other reading programs employ, Headsprout's specific, four-step sequence for teaching each part of the strategy, and linking the steps together (particularly in the absence of an independent listener), is unique.

- **Sentence and story routines** are used to establish meaningful reading. Learners learn word order and sentence sense by first hearing and clicking the words as a narrator reads them, then the learner reads the words as highlighted by the software. Finally, the learner reads the sentence and clicks on a picture indicating what the sentence was about. Stories are then introduced where the learner is released to read independently, applying previously learned skills in a story context. Both comprehension indicators and story indicators are used for these exercises.

- **Fluency routines** are timed, guided-practice exercises that assure retention of newly acquired reading skills after significant periods of no practice, and make application of those skills much more likely (Anderson, Fincham & Douglass, 1999; Johnson & Layng, 1996). Each routine has carefully constructed practice aims, confirmation routines, and correction routines, which are unique to the practice environment. Fluency routines are also designed to adapt to the learners practice history and automatically set practice goals based on that history.

- **Motivation routines** define the contexts in which the previously described routines are embedded and applied. These contexts provide for both program extrinsic consequences (after Goldiamond, 1974), such as vocal praise, fun sounds, and short cartoon movies, and program specific consequences (after Goldiamond, 1974) that occur directly as a function of reading in a social environment.

- **Application routines** include graphic-intensive activities that allow learners to demonstrate their reading skills in real-world contexts, such as interacting with cartoon characters, reading stories in duets with a parent/guardian, and playing mystery or travel games. Application routines also include reading new words and sentences previously untaught and selecting pictures that illustrate the meaning of the word or sentence.

- **Overall sequencing of routines** is also critical to the program's success. Teaching objectives are achieved by the specific mixed and interlocking sequences of the routines described above. Although currently implemented to teach reading, these nine routines may be employed to teach any type of paired associate, multiple discrimination, algorithmic, concept, principle, or strategy learning objective.

**Section III**
Embracing the Burden of Proof: Headsprout's Unparalleled Learner Testing

Just as Headsprout Reading Basics adjusts to the needs of learners, Headsprout learning scientists have built flexibility into the program itself to ensure that those needs are met as effectively and certainly as possible. When Headsprout assures parents that their children will depart each episode with a new skill in hand, it does so with the confidence that comes from unparalleled user testing. Headsprout Reading Basics, which has been developed and shaped by the behavior of actual children, may be the only product of its kind to have undergone such rigorous testing and revision cycles.

Whereas any reading program may undergo scientific evaluation (as recently mandated by Congress in the No Child Left Behind Act of 2001), this does not mean the program was developed scientifically. Indeed, such programs may not have even been based upon principles derived from scientific research. Accordingly, there are three possible development or formative evaluation approaches and three outcome or summative evaluation approaches. The design approach may be one of writing a program based on a philosophy of teaching or personal experience, it can be writing a program based on scientific research and principles (Anderson et al., 2000) or it may be one of painstaking developing a program in accord with rigorous control/analysis scientific procedures (Markle, 1967, Sidman, 1960). The latter approach does not simply incorporate past scientific research, but employs a scientific approach throughout the development cycle. Once produced, each approach's program can be evaluated in accord with the three summative evaluation approaches described in the accompanying Table.

Headsprout has chosen to develop its program according to a strict scientific protocol from the beginning. Every portion of Headsprout Reading Basics has been measured and evaluated, from the most basic level of instruction through the complete interlocking sets of skills and strategies. Three phases of empirical testing were used: developmental testing (developing a workable instructional program), validation testing (verifying that the instruction reliably produces its intended results), and field-testing (maintaining effectiveness across larger and more diverse groups).

Learning scientists, educators, and instructional designers observed more than 250 children interacting with the program in Headsprout's learning laboratory. Under scrutiny
were the basic instructional components, the appeal of the cartoon characters and various program activities, the learners' comprehension of instructions, and their willingness to interact vocally with the program (a factor that precludes the need for voice recognition software).

Above all, Headsprout measured the effectiveness of the lessons for teaching fundamental reading skills. Pretests and posttests of essential skills helped learning scientists and instructional designers measure the acquisition, application and, just as importantly, the retention of skills from episode to episode. Headsprout then made the required adjustments to ensure instructional reliability and effectiveness. This process was repeated until learners were completely successful with the lesson. Over 10 million interactions have been recorded and analyzed to modify, test, and retest each learning routine used in the program until that routine proved effective. Over the course of development, Headsprout made over 10,000 data based program revisions. No change, no matter how seemingly insignificant, has made it into the final product without having been empirically tested and demonstrated effective.

Headsprout designed the program as one might design a new airplane or space vehicle. We did not write it and then test it out to see if it worked. That is, to carry our airplane analogy a step further, we did not build it and then see if more of our airplanes got off the ground and stayed aloft longer than a control group flapping their arms. Instead, we did the careful wind tunnel experiments on the design, tested how the bolts were applied and the materials were used, evaluated how the overall aerodynamics was implemented, and finally answered the question, "Did it fly?" Like an airplane, we felt that a reading program should work on its first test flight, and that changes that came from test flights serve to improve stability and reliability even more. It is not acceptable that the "mean" Headsprout child perform better than the "mean" control group child, just as we would not get in a "mean" airplane. The program must fly with individual children, one at a time. And, as a result of our Internet deployment strategy, Headsprout continues to collect data on every child, which allows the learning scientists and instructional designers to continually improve the product. As more data are gathered, improvements are designed, tested and immediately deployed over the Internet -something even the aerospace industry cannot do.
Table: The Relation Between Formative & Summative Evaluation in Program Design & Assessment

<table>
<thead>
<tr>
<th>A. Experiential</th>
<th>1. Experiential</th>
</tr>
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<tbody>
<tr>
<td>Derived from philosophy or personal experience</td>
<td>Correspondence to a point of view—philosophy or personal experience.</td>
</tr>
<tr>
<td>i) Consensus of best practices, experience, point of view. Little or no testing during developmental process itself.</td>
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<tr>
<td>ii) Design revisions based on consistency of content with prevailing point of view.</td>
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</tr>
<tr>
<td>iii) May employ limited group tryouts that result in some program revisions. Clarity of communication typically the issue.</td>
<td></td>
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<tr>
<td>B. Evidence Based</td>
<td>2. Evidence Based</td>
</tr>
<tr>
<td>Derived from scientific principles</td>
<td>Provides some indication that the program may be effective with a group.</td>
</tr>
<tr>
<td>i), ii), &amp; iii) as above.</td>
<td></td>
</tr>
<tr>
<td>i) Design largely based on previous research, which may come from a variety of disciplines. Research may be on elements found in program content and not program itself.</td>
<td></td>
</tr>
<tr>
<td>v) Design revisions often based on consistency of content with prevailing point of view. May employ scheduling for adherence to research.</td>
<td></td>
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<tr>
<td>C. Scientifically Designed &amp; Validated Individual Research</td>
<td>3. Scientific Group Research</td>
</tr>
<tr>
<td>Content may not be, but is typically derived from scientific principles and developed according to scientific control/analysis procedures (Headsprout Approach)</td>
<td>Controlled group studies, measured against other programs, standard or placebo.</td>
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<tr>
<td>i), ii), &amp; iv) as above</td>
<td></td>
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<tr>
<td>vi) All elements of program tested for effectiveness; if fails criteria, alternative built and tested. Processes iterate until criteria met. Performance is always measured against a set of criteria.</td>
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<tr>
<td>vii) Sequence of program steps and the relation of behavior to the sequence is explicitly identified, thereby, generating new knowledge. Process continues and is aggregated as response requirements &amp; &quot;chunks&quot; of the program unit change in size (e.g., a segment of a lesson, a lesson, groups of lessons, the program).</td>
<td></td>
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<td>viii) Research based on and systematically replicated with individuals; therefor, can generalize to individuals (Neuman &amp; McCormick, 2002; Sidman, 1990).</td>
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<tr>
<td>Provides some indication that the program may be effective with a group.</td>
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<tr>
<td>Can confidently predict group performance.</td>
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<td>Can confidently predict group performance.</td>
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**3X3 Matrix.** The level of rigor for each type of evaluation is indicated by the letters A - C for formative evaluation, with row C representing the most rigorous; the numbers 1 - 3 indicate the level of rigor for each type of summative evaluation, with column 3 representing the most rigorous. Cell C-3 represents the most rigorous intersection of formative & summative evaluation.

**Section IV**

**Enabling Evolution: Headsprout's Recombinant Teaching & Engineering Models**

Interestingly, the development and evolution of the product itself mirrors the development and evolution of the teaching process within the product. Headsprout uses a recombinant model (Johnson & Layng, 1992; Lee & Anderson, 2001) in which component letters and sounds are taught and then combined to form a composite, which then becomes a component of a word. Words then become components of sentences and sentences of stories. This unique model is also applied to the instructional framework of Headsprout Reading Basics' episode sequence. Instructional techniques (components) are recombined (into composites) to form the pedagogical foundation of each episode. This entire process is analogous to chemistry: atoms of various elements (always themselves the same) come together in various combinations to yield different molecules. This model also extends to the engineering process. Because the modular computer code underlying component instructional techniques can be reused with different content or with different graphics, Headsprout achieves great efficiencies in product development. The modular structure also enables Headsprout to promptly take advantage of the observations and data gleaned from user testing; if necessary, changes can be incorporated across several episodes with relatively little effort.

In all of these cases, some of the instructional components are no longer used over the course of the program because learners "learn how to learn." In other words, they become more efficient in acquiring new knowledge and can learn new things in different, more sophisticated ways. This is yet another instance of Headsprout's ability to evolve along with the learner. These early skills will, of course, continue to be practiced and applied as implicit aspects of other activities. For example, practice with letter/sound combinations is reinforced as learners move on to deciphering whole words and sentences.

**Headsprout's Internet Advantage: Broad Availability and Continuous Improvement**
One of the crucial ingredients in Headsprout's success—perhaps transcending the pedagogical, developmental, and technological innovations described above—is delivery over the Internet. Although the Internet is Headsprout's distribution system and not its defining technology, it is central to the effectiveness of the product. The Internet model enables Headsprout to make changes and improvements to the product at any time, without forcing expensive and/or inconvenient updates on consumers. The program can adapt to every learner's behavior because all learning data is up-loaded to Headsprout servers for analysis. More importantly, the Internet makes every non-reading, Internet-connected child in the world (i.e., millions of kids) a potential Headsprout beneficiary.

The end-user experience is uniformly smooth, which is especially crucial when the user is a young child. Headsprout's code is engineered for streaming, allowing Headsprout Reading Basics to run seamlessly, even over 56K modems. Learners spend very little time waiting for program segments to begin because successive segments are downloading in the background as they work. In the event that they do have to wait, any one of thirty interactive screens appears to help pass the time; they can scroll or click to make entertaining changes in the graphics. Also important are the Macromedia Flash animations that drive the entire program and entertain and motivate children as they learn. There are dozens of cute characters featured in Headsprout's episodes; all of them have been created and animated in-house, drawing upon Headsprout staffers' graphical, vocal and instrumental talents to enliven them with motion and sound. In marrying "state of the science" learning theory, Hollywood entertainment, and Silicon Valley technology, Headsprout has created an Internet technology that seamlessly provides effective reading instruction.

Headsprout Reading Basics: Empirical Data

The scientific basis for our claims comes first from a thorough grounding in measurement. We measure all opportunities to interact with our program and all learner interactions on a real-time basis for all learners via the Internet. For each individual learner, we know:
• how many responses were made (in the program, in an episode, or in a segment), which is used to determine rate of responding within and between episodes and segments;
• how many of these responses were correct and how many were errors, which is used to determine correct and error rates; ratios of corrects to totals and corrects to errors;
• the error response made, if any, which is used to determine error patterns or potential discrimination problems and what skills are not ‘firm’;
• the latency (time between opportunity and response) of all responses, which is used to determine the strength of response, or the amount of "think time" a child may require;
• the screen position of all responses, which is used to determine and counteract any position biases or inadvertent clues; and
• the amount of time the learner spent in each interaction, segment, and episode, which is used to determine skill, strategy and episode sequences.

**Instructional Adaptability**

Because Headsprout Reading is broken down into tactics and strategies targeting specific skills, our data inform us about the effectiveness of each instructional strategy across all children and for every individual learner. The data are used to modify the instructional sequence to meet the individual needs of our learners, as well as to continually shape and redesign the overall efficacy of the program. Headsprout knows immediately what works and what doesn't, and can continually make revisions and test them against the established procedure, selecting the procedure that produces the best result.

**Learner Performance Data**

All learner performance data are automatically collected and entered into a database allowing us to look at individual performance as well conglomerates of these data. For example, we analyze the number and rate of opportunities to interact, responses and corrects per episode, response fluency, episode and segment durations, and errors patterns to evaluate learner outcomes. We measure accuracy on literal comprehension tasks and the recombination of taught skills into new skills to obtain indicators of more generative reading skills. Each activity or teaching routine in the program has a designated mastery criterion, which, with exception of the practice exercises, is always 100% accuracy over a consecutive sequence of trials. Failure to reach mastery results in the learner being provided a corrective
teaching sequence specific to the particular error pattern. The student is then returned to the mastery sequence, and must demonstrate mastery prior to exiting the activity. Learners are required to meet more challenging mastery criteria as they progress through the program. The program is designed to maintain a high level of correct performance as these criteria progressively change during the program.

An additional source of data comes from the videos made of each learner in our laboratory interacting with the program. By way of a split screen, these tapes show both the learner and the display screen as seen by the learner. These allow us to measure and evaluate both learner affect and specifics regarding eye gaze, attention, reactions to the cartoon sequences.

Figure 1 depicts the growth of fundamental reading skills as a function of progress through Headsprout Reading Basics. Headsprout administers computer-based pretests and posttests with our on-site user test children for each episode presented. These pretests and posttests assess the specific skills targeted for each episode. We have consistently found steady increases in letter/sound reading ability where previously there was little or none.
Figure 1. Outcomes as a function of lessons completed.

Figure 2 depicts the ratio of correct to total interactions for over 1000 beta (field-testing) participants. The relatively high correct percentages demonstrate the error reduction and cumulative shaping nature of our program—where new skills are built upon previous skills and there is not an abrupt learning curve for our learners. Correct responding criteria are maintained even as the program requirements become more demanding. The high percentages also reflect our rigorous accuracy criterion that is met on each segment before a
A learner completes an episode. Each episode reinforces some prior learning and introduces new sounds, skills, or strategies necessary for ultimate reading success.

Figure 2. Average percent correct per Headsprout Reading Basics episode. Data are for over 1000 learners.

Figure 3 shows the amount of time it takes our learners, on average, to complete an episode and meet the instructional criteria for exiting segments and episodes. These data assist in arranging the logical flow of instructional sequences while not taxing our learner's ability to be motivated and successful. On average, Episodes take 20 minutes to complete and range from just under 10 minutes to slightly over 30 minutes. The data were collected from over 1000 beta test learners.
Figure 3. Average duration per Headsprout Reading Basics episode. Data are for over 1000 learners.

Opportunities, responses and corrects are also monitored. Figure 4 displays the ratios between opportunities (each time an learner interaction is available), responses (actual learner interactions, where the child is making a response) and corrects allow us to evaluate the effectiveness of episodes and segments on a response-by-response basis. It is this fine-grained analysis of individual learner performance (from which this graph is compiled) that gives us confidence in replicating these outcomes for over 1000 learners.
Figure 4. Mean number of response opportunities (bars), total responses (filled circle), and correct responses (open circles) per Headsprout Reading Basics episode. Data are for over 1000 learners.

Section V

Reading Outcomes

Figure 5 depicts measures of individual performance on specific word and sentence reading skills and provides additional verification of outcomes. Well over 90% of children tested have demonstrated substantial improvement in their ability to read words, sentences and short stories. The outcomes represented in Figure 5 show words read correctly in printed Headsprout Readers. These data show reliability of effects (accurate story reading) during systematic replication for initially non-reading pre-schoolers during developmental testing. There was a minimum of 15 children tested in each phase to ensure a reliable systematic replication. Each pair of bars represents the pretest and posttest number of words read.
correctly in each storybook. Prolonged hesitations and self-corrections were scored as errors along with word substitution and failure to read a word. There are six full-color "Headsprout Reader Storybooks" in the program. Increased accuracy in pretest scores across episodes was a function of words learned in previous phases occurring in later storybooks.

![Graph](image)

**Figure 5.** Systematic replication depicting the reliability of effects (accurate story reading) for initially non-reading preschoolers during developmental testing. Data are for a minimum of 15 individual learners per testing phase (increasingly complex reading passages). Pretest corrects in post phase 1 (See!) indicate carryover of words learned in previous passages that were reused in later stories. Number of words (indicated by the bar) read correctly (dark area) on first try on pretests and posttests using Headsprout Reading Basics storybooks.

Figure 6 indicates how carefully designed instructional sequences provide a stability of effect across numerous learners. Over 90% of our learners average over 90% correct responding in the program, and complete several learning objectives within each approximately 20-minute lesson. Learners engage in approximately 190 individual interactions (or learn units, [after Greer, 1994] with each interaction comprising a presentation, a response, and a consequence), and an average over 180 correct responses per
The program is highly interactive--learners engage in over 9 responses per minute, across all 40 episodes.

Outcomes Across Learners and Episodes (latest program versions)

![Graph showing outcomes](image)

**Figure 6. Summary of program outcomes for Headsprout Reading Basics. Means calculated for over 1000 learners.**

**Demonstrated Effective**

The Woodcock-Johnson Letter-Word Identification subtest (Woodcock, McGrew & Mather, 2001), was administered to 20 initial primarily Pre-K children after the completion of 40, 20-minute lessons (less than 15 hours of instruction) as part of in-house developmental
testing. Figure 7 shows a mean gain for the 20 children of one year, moving from a grade-level score of 0.5 (Kindergarten 5th month) to grade 1.5.

**Figure 7. Mean grade-level scores for 20 initial developmental testing completers on the Woodcock Johnson Letter-Word Identification Subtest prior to and after finishing Headsprout Reading Basics.**

Early field-testing standardized test scores for 30 kindergarten students from Thurgood Marshall Elementary School in Seattle, WA, shown in Figure 8, support the data derived from criterion-referenced tests, and standardized tests administered during developmental testing for individual students. The school demographics were:

- American Indian: 1 %
- Asian: 13 %
- African American: 63 %
<table>
<thead>
<tr>
<th>Ethnicity</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Latino</td>
<td>17%</td>
</tr>
<tr>
<td>Caucasian</td>
<td>6%</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
</tr>
</tbody>
</table>

Twenty-three students were tested on the Diagnostic Reading Assessment (DRA) test (scheduling conflicts accounted for the difference in test participants). On the DRA, 100% of the students scored at or above grade level with 82% of the kindergarten students scoring from early to mid first grade. In prior years no more than 50% of students scored a grade level.

![Developmental Reading Assessment (DRA) Outcomes](https://www.headsprout.com)

**Figure 8.** Effects on DRA outcomes of supplementing an existing Kindergarten curriculum with Headsprout Reading Basics. Previous years (light bars) are compared to 2001-2002 (dark bars) Kindergarten student scores.
Section VI

Educator Feedback

In addition to the preceding quantitative data, we have received a great deal of qualitative feedback from teachers and administrators who have used Headsprout Reading Basics. They have found Headsprout easy to implement, extremely effective, and fun and engaging for their students. Following is a sample of some comments received from educators:

"All of our Kindergarten students finished Headsprout and many of them are able to read non-Headsprout texts. It's very exciting. I'm looking forward to next fall when we should have a bunch of students entering First Grade who already know how to read…Thanks."

Ms. Emily Severance, Reading Specialist, St. Paul's School

"The kids love Headsprout. I thought my lower readers would be the only ones to really benefit from this endeavor but all of my students have improved from the extra practice! It is an excellent program. Once the children begin a lesson they are very independent. The children enjoy the program… they ask to go to the computer at free play time!"

Ms. Erica Ernest, 1st Grade Teacher, Central Lutheran Elementary School

"Everyone loves the program. I had a teacher in grade K tell me that she has noticed a difference in the kids on the program. I really like the report format."

Mr. Eric Demeter, Teacher, Clark Elementary School

"Headsprout excites my students about reading and gives them confidence. They're so proud to read me their books... It’s excellent!"

Ms. Christine Narayan, Teacher, Branson School

"One of my first grade groups chose to go to the computer lab to work on Headsprout instead of staying in their classroom for their holiday party. The class was getting ready to exchange gifts but 5 out of 6 of the students wanted to postpone their present exchange so that they could use Headsprout. I think that’s a pretty good testimonial to how engaging your lessons are."

Elementary School Reading Specialist, Harlem, New York

"I have to write and say that I am quite impressed. Your program does all you say it does, and makes it very easy to introduce a child to reading. As a certified elementary school teacher, I am
amazed at the efficiency and effectiveness of the program. I especially enjoy that it is individualized…Great program!"

Elementary School Teacher, Washington

The kindergarten children love Headsprout. They really get excited while learning and love the animated "breaks" with the songs and music. It is exciting for me to watch kids learn to read with Headsprout and have fun doing it.

Mr. John Humphrey, Education Consultant, Cedar Rapids, Iowa

Thank you so much for designing a truly workable program for typical children and special needs children alike. Thank you also for being so attentive to questions and the needs of special kids.

Behavior Specialist, Salinas, California

"I just want to tell you how pleased we are with this program. It is remarkable, and well worth the money. Congratulations on a fine contribution to education."

Dr. Chris McDonough, Principal, Hawthorne Country Day School

"I just wanted to take this opportunity to tell you how much we have enjoyed working with Headsprout and with the customer support we have experienced. Our students are thoroughly enjoying the program! It is well organized instructionally and has students excited about their learning process."

Dr. J Aufderheide, Superintendent, Branson School

Section VII

Conclusion

Headsprout Reading Basics is the culmination of a major research and development effort that finds its roots not only in the content required for successful reading instruction, but also in the strategies for teaching that are the outgrowth of years of work provided by many dedicated behavioral and learning scientists. It is constructional in its design (after Anderson, Reder & Simon, 1999; Goldiamond, 1974; Skinner, 1968), comprehensive in its development (after Holland et al, 1976; Johnson and Layng, 1992; Lindsley, 1997; Markle,
1969, 1990; Tiemann and Markle, 1990; Skinner, 1957), and rigorous in its evaluation (after Markle, 1967; Sidman, 1960; Sidman and Stoddard, 1966). In summary:

- Each lesson appears as an interactive, animated Web episode and takes about 20 minutes to complete. At 3-5 episodes a week, a child will be able to complete the entire program in less than 12 weeks.
- Through highly interactive, positive experiences, a child learns that letters and sounds make words, words make sentences, and sentences make stories.
- Headsprout automatically adapts to a child's pace as it teaches. A child leaves each lesson feeling successful.
- Books are an essential part of the program - every few lessons a child receives a Headsprout Reader booklet, to encourage independent reading. Plus, you'll find a variety of other printable stories on the Headsprout Web site.
- In less than 15 hours of instruction (40 twenty-minute lessons), a child will read over 20 Headsprout stories; many with words sounded out and read for the first time.
- Children track their progress with colorful Headsprout Progress Maps. Detailed progress reports for each child are available online.

When learning to read is fun, children want to learn. This is fundamental to Reading Basics, and the reason Headsprout designed the program as a series of engaging, Internet-based, animated lessons that teach basic skills for reading. But, the real motivation, reflected by joy, pride, confidence, and enthusiasm, comes from the social reinforcement that being able to read brings to each child.

References


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, DC: U.S. Government Printing Office.


